JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

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EDITORIAL NOTES—GAS, &c.

Improving the Existing.

THE trend of gas invention, as portrayed by the abstracts of patent specifications published, as regularly as circumstances will allow, week by week in the "JOURNAL," must always remain a fascinating study for those who are concerned in the technical progress of the industry. We are at the present in an extremely interesting position in all the many branches affecting gas production and utilization. The past few years have witnessed in almost every direction material advance in the way of complete departures from the old forms of doing the same things, for the purpose of achieving further economy and realizing generally more brilliant results. But—if we except for the moment the vertical retort system, whose best lines are still in an indeterminate state—what is being largely striven after in the present, in every line of inventive activity, is the improvement of the efficiency of the latest approved types without seeking any further radical departures such as latter years have seen. There appear to be stages in inventive progress when new openings are completely concealed from view, and when the inventor and the searcher after fresh light and truths are restrained by hidden forces to the penetration of those secrets that yield from the existing increased profitable results to the common advantage. Go for illustration to the greatest of all the examples of applied mechanics—the steam-engine. After the advent of this engine, generations of engineers came and went, and long years passed; but all the while men and time were devoted to the gaining, from the same fundamental principles, of greater efficiency—to the realizing of greater effective power from the fuel consumption. But it is only in the latter years that we have the radical departure in the shape of the steam-turbine, to the further improvement of which—by the eradication of defects, and by obtaining from it still higher efficiencies upon those already high—work is being unremittingly directed.

The simile will be found to be strikingly comparable with the technical situation in the gas industry on reading the article on "The Trend of Gas Invention" in another part of this issue. If we look at the section of carbonization, the whole of the work that is going on now does not by any means partake of any radical departure from now established lines, other than in the adaptation of the vertical retort to the conditions and requirements of the gas industry, and the supplementing of that system with those mechanical habiliments for which it is so peculiarly fitted, and by the aid of which it is fervently hoped there will be produced a combination of economical result that will raise the system superior to all that at present exists. True the task that the vertical retort improvers have undertaken is a large one, in view of the continuous labour, with the same objects, in connection with existing retort-house methods. That is where technically in all branches we are at present. Experimenters and inventors are attempting to raise the productive and effective status of what is already in being, without any abandoning of hopes that from beyond the limits of contemporary knowledge there are great reserve forces for the gas industry still waiting to be revealed. In retort furnaces and settings, our "Register of Patents" shows us there are spasmodic endeavours to further improve upon the already high efficiency derived from them. In the structural form and setting of retorts, the same. In the charging and discharging of horizontal retorts, the departure of a few years since that made operation possible from one end of the retorts, has been accepted; and there has appeared nothing of late that is both new and practicable that is a desertion from the approved rotary projector or the system of charging and discharging in one operation. The fundamental lines and principles remain; and the work that has been going on, in connection with both systems, has been kept in the channel of effort to improve or vary means. There has been more or less success—success chiefly in producing the same effect by a change of method, though not always without a little diversion from simplicity to complication. It is expected that we shall shortly see demonstrated a new example of the type of machine which expels and recharges in one operation. To coal and coke elevators and conveyors, the foregoing remarks will also apply. Certain principles of construction have been stereotyped; and improvement at the present time is being sought in detail. And so through all the other departments of manufacture and distribution, until we come to the utilization of gas.

In the utilization of gas, the review of invention reminds us, a similar condition prevails; and, indeed, no one expects, in this direction or in any other, that new departures will be matters of daily occurrence. After the discovery of the incandescent mantle, and its adaptation to the vertical bunsen burner, the first great diversion from common use was the outside accompaniment of high-pressure gas, or else high-pressure air, and following this the successful combination of inverted bunsen burners with the mantles. The day is remote as things move now when these things came to aid in the utilization of gas; and investigators and inventors have not discovered any new thing to supersede them, but have concentrated attention upon their improvement, and most successfully. We do not believe that the end in economy and efficiency has been reached with the means now available. There are, our "Register of Patents" is constantly reminding us, many who labour to that end; but from their work, and from what at present exists, we cannot yet see, nor are there signs on which anyone can venture to predict, where, when, or how something that can be called a really new departure in gas lighting is likely to arise.

All are at present highly satisfied with what are the possessions of the gas industry. Even so, the resources of the industry are large, the field is broad, and the opportunities many; and in neither one direction nor the other—manufacture or utilization—is hope confined to advance being limited to the improvement of what now exists. With accrued and accruing economy and efficiency, forward movement naturally becomes the more difficult. But upon the forward movement our "Register of Patents" tells us that a little army of workers are constantly labouring, and are ever alert. The past is full of encouragement for the present; and in the future, we doubt not, science and practical endeavour working in unity will yield an abundant progress in economical and efficient production and service, to the advantage of the industry at large and those it serves.

A Notable Presidential Address.

IT is with much satisfaction and pleasure that we call our readers' attention to a presidential address, the translation of the first portion of which will be found in another part of our present issue. Its author needs no introduction from us; for M. Emile Cornuault, as a French gas engineer and administrator, has achieved a high reputation which long ago crossed the Channel, as he himself also has frequently done. In this connection, it may not be without interest to record the fact that M. Cornuault has by no means confined his great abilities to gas affairs; for he is also a Director of the London General Omnibus Company. Having been President of the Société Technique de l'Industrie du Gaz in 1889, he is an honoured and honorary member of the Institution of Gas Engineers. His elevation, therefore, to the Presidential Chair of the leading Civil Engineering Society of France—the Société des Ingénieurs Civils—is a matter of congratulation not only to members of that prosperous

institution, nor only to our colleagues of the French Gas Society, but also to us in England. In thus conferring upon M. Cornuault the highest honour that French civil engineers can bestow, they have thereby conferred a mark of distinction upon the gas industry as a whole. Our warmest congratulations are offered to the gas engineer who is the present President of the Société des Ingénieurs Civils de France; and we shall hope some day to see the example of the French Institution of Civil Engineers emulated by our own Institution in London.

M. Cornuault's address was delivered on the 4th inst., at the home of the Society in the Rue Blanche, Paris, where the French gas meetings have also been frequently held. Almost needless to say, the presidential discourse took the form of a chronological and historical account of gas lighting; and the wonderful story of its development and progress was admirably unfolded before his audience of civil engineers of all branches, who loudly applauded its delivery. The constructional and manufacturing sides of the gas industry were not dealt with; illumination, and chiefly public illumination, being the main topic. M. Cornuault approaches the subject naturally enough from the French point of view, though his outlook, as will be gathered from what we have already said of his distinguished career, is by no means a one-country or a one-sided vision. This is distinctly shown in the latter part of his address, where he records the gas consumption of towns in eight foreign countries; and also in the broad and impartial way in which he refers to the competition of the electric light. As a gas-lighting advocate, he is by no means afraid of this, or any, competitor; and he gives ample figures to support the faith that is in him. Thus, in Paris the gas consumption during the last ten years—notwithstanding electrical and other competition—has increased by 30 per cent., from 270 million cubic metres in 1897 to 350 millions last year. Such increases—we know and M. Cornuault well shows—are not confined to any one town or to any one country. As is said of Science, so may it with equal truth be said of gas progress—it knows no nationality and has no frontiers. Figures of representative towns in half-a-dozen different European countries quoted by the President, show that, in the last decade, their total consumption of gas has gone up by no less than 80 per cent. Some individual cases are, of course, much higher even than this—the highest being 136 per cent. increase at Basle. To show, also, the great development that has taken place in the use of gas for heating in addition to lighting, two towns are chosen because of their being so well equipped with the electric light. The actual figures year by year are given from 1896 to 1905; and in one case, the gas for lighting has increased in that period by 18 per cent., while the augmentation due to gas for heating is 142 per cent. In the other and smaller town chosen, the corresponding percentages of increase are 60 and 570. Truly, only the fringe of the field for gas extension has hitherto been touched.

The first public gas lighting was done in Paris in the Place du Carrousel on Jan. 1, 1829; so that we in England, however much the claims of Murdoch to be regarded as the inventor of gas lighting are disputed, have the satisfaction of anteceding this date by fifteen years. Westminster Bridge was lighted by gas-burners on Dec. 31, 1813; and the parish of St. Margaret's, Westminster, on April 1, 1814. It may be true of France that, as M. Cornuault says, "it "was only after 1830 that lighting by gas practically estab- "lished itself;" but its practical advent in this country was certainly much earlier than that. We should have been glad if the President's interesting and concise summary of the characteristic periods of lighting had been extended from 1880 to the end of the last century, instead of leaving off at the former date. We should also have liked to have been told some more about high-pressure lighting. But it seems ungracious to ask for more where so much has already been given us. We can strongly recommend to the notice of students M. Cornuault's clear, historical account of the progressive stages of gas-burners. They will there see how the French standard of light, the carcel, was first obtained by consuming 130 litres of gas in a flat-flame burner; then by 70 litres in a regenerative burner; next by 20 litres in an ordinary incandescent burner; and now even by 10 litres in an improved one. Thus by successive minds, by plodding workers, and by painstaking experimenters, has the efficiency of coal gas been increased over tenfold. The lesson is that there is no such thing as finality in human effort and human progress; and we in the gas industry may all still play our part in the triumph of it.

London's Expenses in Fighting for Liberty for Gas.

By returns that were issued by the Local Government Board last week, the ratepayers of London had light thrown upon the enormous spendings of the London County Council and the Borough Councils in promoting and opposing Bills in Parliament. The activity of the County Council since their work came under the domination of the Progressive Party, and more especially their meddlesomeness with all forms of private enterprise, have become notorious; and it is a reproach to our methods of local government that such outrageous waste as is shown by these returns to have taken place should be possible. There is no restraint whatever, so far as the County Council are concerned. They are, in fact, a law to themselves in this matter. A mere vote of their own, without any reference to the ratepayers, will carry them into Parliament to attack or to be attacked, regardless of expense. In the four sessions from 1903 to 1906 (part of the costs are estimated so far as the latter session is concerned), the ratepayers of London now learn that the Council have indulged in some good, but mostly speculative or useless, work in Parliament at a total cost of £101,032, made up of £67,966 spent in promotions, and £33,066 in oppositions. A large number of the Bills promoted have been rejected by Parliament, or have had to be withdrawn; and the advantage achieved by opposition has had a diminutive appearance in contrast to the cost. The return relating to the Borough Councils cover a longer period by two sessions; and in that time they have managed to spend £71,933 (£62,089 having been in oppositions), which, added to the County Council's £101,032, makes a grand total of £172,965. This is an enormous sum for the ratepayers to have had to pay in such a short period for parliamentary expenses. The portion of the amount that has been wasted is in a small degree perhaps a result of the divided administration to which London is exposed; but in larger degree it is due to the gorgeous ideas of our Metropolitan rulers. With those ideas the grand total above mentioned has a commensurateness which perhaps (if we could only see the matter in the light of progressivism) is right and proper, though submitted to the judgment of our own intelligence, it appears to be somewhat appalling. Only those who are engaged professionally in Private Bill work—the lawyers, agents, and expert witnesses—who reap from this wild sowing can raise their voices in joyfulness.

The period covered by these returns is that during which the London Gas Companies and the South Suburban Gas Company have been fighting for greater liberty for themselves and for the gas industry at large; and it is found that the price that has had to be paid to carry the fight to a successful issue has been a heavy one, and all through the frantic efforts of the County Council and the Borough Councils to neutralize the action taken to obtain the countenance of Parliament to changes to assist the natural advance of the industry. The County Council and the Borough Councils blocked the way of progress—successfully for a time, but right and commonsense eventually prevailed. The ratepayers and the gas consumers, however, have had to foot the bill representing the parliamentary operations against the Companies. For the ratepayers and consumers, the money so spent, in the result, has been so much money destroyed; and the total is anything but an insignificant one. The County Council's expenses during the past four sessions in promoting three Gas Bills and in opposing eleven Bills promoted by Gas Companies have amounted to £5297, of which £2330 was spent on promotions, and £2967 on the hostile expeditions against the Companies. In a note to the London Gas Bill of 1905, which the Council promoted, it is said that "the Bill became law." But it is not said that the Bill that "became law" was not the Bill as introduced by the Council. However, that is now a matter of history; and our present object is the exposure of the waste there has been of public moneys and the loss to the ratepayers and consumers in what has been, if the position of 1903 is compared with the situation in 1907, purely abortive opposition. For what was sought a few years ago is what obtains now, with slight modifications.

Examining the return relating to the Metropolitan Borough Councils, the expenses of opposing the Bills of the London Gas Companies and of the South Suburban Gas Company since 1901 amount to a total of £2393. So that the County Council since 1903 and the Borough Councils since 1901 expended between them £7691 in connection with gas legislation. Over the persistent, and ultimately

victorious, efforts of the South Suburban Company, the Borough Councils (chiefly the Lewisham district authority) since 1903 have spent the sum of £864, and the London County Council £1798, or together £2662; and we know that the Company, in the four sessions' campaign, were involved in an outlay of something like £10,000. It may therefore be said that the struggle for greater freedom on the part of that one Company cost the ratepayers and consumers, in round figures, £13,000. But that is not the whole of the tale. A computation that we have made of the parliamentary expenditure of the three London Companies during the three-and-a-half years ending June 30 last, shows that it amounted to £25,000, or thereabouts. A small part of this was no doubt spent in protecting the Companies' interests in other ways; but the bulk of it was expended over those matters that have been projected so prominently into the recent history of the gas industry. Adding together the £25,000 spent by the London Companies, the £10,000 spent by the South Suburban Company, and the £7691 spent by the County Council and the Borough Authorities, we have a total of £42,696, which may be taken to be a very fair indication of the price that has been paid in London, in the past four years, in successfully carrying through the struggle for the greater freedom that is now enjoyed by the gas industry. And to this ought to be added the large amount of money spent, preceding the period covered by these big figures, by the South Metropolitan and Commercial Companies, in breaking down the 16-candle power gas standard for London, together with the sum expended by the London County Council in obstruction. The South Metropolitan Company alone in 1900—the year of their 14-candle power Gas Bill—expended on parliamentary work between £8000 and £9000. What was then accomplished has resulted in the adoption of a 14-candle power gas standard in the model clauses. Then there was also the expenditure of the Companies in protecting the industry against the application of portable photometry at the instance of the London County Council.

The industry will most jealously guard the gains and the restoration of just conditions that have been so dearly won; and there will be no thanks to those who would in any way attempt to betray the interests of the industry. A great victory does not always result in an immediate state of single-mindedness between the victors and the vanquished; and there are bound to be petty outbursts before all antagonism dies out. The reference to the Board of Trade of the dispute between Southport and Birkdale as to the adoption by the former of the Metropolitan argand burner No. 2 (as reported last week) is a little outbreak of opposition to a fair and equitable method of testing gas of all illuminating qualities within range of English statutory standards. There has never been a test-burner before this that was capable of doing justice to gas of all qualities. Such a test-burner has been a desideratum; with it in actual possession, it is so no longer. For lack of any better argument, it is contended that the burner does not act fairly towards the user of flat-flame burners. The user of flat-flame burners has a short road, through the incandescent burner, of obtaining an adjustment with interest of any loss he is supposed to suffer, by securing a greater duty from his gas than he has ever obtained before. Those who oppose the new test-burner on such grounds are engaged in the quixotic task of essaying to protect the indolent and the laggard. For the sake of such, the industry does not intend to be held back; nor must the prudent gas consumer be made to suffer for the imprudent. What the London Companies have gained for the industry by incessant toil and a no mean expenditure of money, time, and labour, must redound, as the effects accrue, to the common advantage of the gas consumers and the industry.

Construction and Lighting of Purifier-Houses.

THE explosion in the purifier-house at the Brunswick Street works of the Alliance and Dublin Consumers' Gas Company has been the subject of inquiry by the City Coroner, owing to one of the victims having succumbed to his injuries. Much as even the loss of a single life is to be deplored, it is highly gratifying, in view of the number of men working in the house at the time of the accident, that we have not to chronicle a greater destruction of life. For the Chairman (Alderman W. F. Cotton, J.P.), his colleagues, and the officials of the Company, it will always be a matter of thankfulness that, in the construction of this house, everything to the best of knowledge prior to the accident had been done to ensure safety. It was not an enclosed house; being open on all sides but one. The purifiers, too, were raised 16 feet from the ground, and they are not roofed over. Had it been an enclosed building, there can be no doubt that the sacrifice of human life would have ranked among the greatest in the history of gas-works operation. According to a statement at the inquest by Mr. John Jackson, one of the Inspectors of Factories, the Home Office has recently drawn the attention of the Inspectors to the question of the conditions of purifier-houses—no doubt particularly as the result of the lamentable explosions at Saltley and Coventry, in both of which cases the purifiers were in enclosed—of course, ventilated—houses. It is satisfactory to know, Mr. Jackson was able to testify, that the house at Dublin largely complies with the recommendations of the Home Office. It also transpired, from Mr. Jackson's observations, that the Home Office has directed that portable, self-contained electric lamps should be used in purifier-houses, in place of the old-fashioned hand lamps.

This touches upon the cause of the ignition of the gas in the Dublin purifier-house. It is a matter upon which no one can speak positively; but there seems room for very little doubt that, as was suggested in an editorial reference to the subject last week, the fusing of an electric wire introduced all that was needed to produce the explosion of a temporary accumulation of gas under the purifiers. The Company's Chief Engineer (Mr. W. F. Cotton, jun.) suggested as a possible alternative—although not disputing that a defective electric wire might have been the cause—that a hopper-door under the purifier upon which work was proceeding, by striking the bottom of the box on being smartly opened, might throw off a spark sufficient to ignite gas. Against this theory, is the testimony of Mr. Waterfield (the Assistant Engineer) that shortly before the explosion he was under the purifier, and all was right then (in the report, however, it does not state whether this was before the opening of the hopper-doors), there is the evidence as to the electric wire being stripped and its fusion, and there is Mr. Jackson's opinion that an electric wire was the cause of the accident. In this case one of the wires passed between the two hopper-doors under the centre of the box where the explosion took place. This testimony all tends to support the contention of last week (and in the interests of future safety elsewhere, it must not be regarded lightly) that, in the rough work of a purifier-house, flexible and exposed electric wires are not desirable, and that where incandescent electric lamps are applied (as in this instance) for safety, the lamps should be fixed and wires and bulbs be properly protected. For the use of the men where they require a light closer to the work on which they are engaged than is afforded by the fixed lights, a portable electric lamp, with dry battery, is preferable. The Company, it is understood—and this is further evidence of their belief in the guiltiness of the fused electric wire—are going to substitute for the wired lamps that the men have been using, portable self-contained hand lamps. In many gas-works in the country, electric lighting is the vogue on the score of safety, in those buildings where, accidentally, explosive mixtures may be formed. To the engineers of such works, this accident will be suggestive, and where necessary, precautions will accordingly be taken.

The Presidency of the Midland Association.

The annual meeting of the Midland Association will be held on Thursday, Feb. 28; but the members will not have the felicity they have been contemplating of welcoming to the chair the President of their choice for the ensuing year—Mr. J. H. Brown, of Nottingham. Confirmation of the resignation of Mr. Brown of the presidency—a step that was foreshadowed in our news columns on the 1st inst.—has been received from the Hon. Secretary of the Association (Mr. Charles Meiklejohn, of Rugby); and the further information is afforded that, on the unanimous wish of the Committee, Mr. Hubert Pooley, of Stafford, has kindly consented to at once proceed to the presidential chair, and Mr. Harold E. Copp, of West Bromwich, to the vice-presidency. The paragraph in the "JOURNAL" on Jan. 1 indicated generally the causes that have led to Mr. Brown relinquishing the office, the acceptance of which was with the full concurrence of the former Corporation Gas Committee. The Association Committee realize that, under the circumstances in which their late President was placed by an ungenerous section of the Committee now

in charge of the Nottingham Corporation Gas Department, Mr. Brown could not have taken, on his own behalf and on that of the Association, a more dignified course. Naturally the Committee of the Association and the members generally will regret that Nottingham should happen to possess the one example of a Corporation Gas Committee some of the members of which—through we presume stubborn ignorance—fail to appreciate the value of the work of technical organizations. Such ignorance will withdraw from the Nottingham Committee the respect of all intelligent men in the gas industry. A greater regret to the members of the Association than the loss of a visit to Nottingham, will be that of the loss of Mr. Brown at the head of affairs in the coming year; but of this we may be sure, that with the regret is mingled the complete sympathy of the membsrs. This incident has not done anything to mitigate the unpleasant aspects of recent events in Nottingham; and the Gas Committee have certainly lost an opportunity of doing something towards retrieving lost honour.

The Lighting of Railway Premises.

Very good use was made by the speakers of the forty-five minutes, or thereabouts, that were allowed at Friday's meeting of the Institution of Mechanical Engineers for the completion of the discussion of Mr. Henry Fowler's paper, on the "Lighting of Railway Premises," which was adjourned at the December meeting. Last month, Mr. Fowler's paper was preceded by the conclusion of the discussion of a communication on an altogether different subject; and on Friday there was a long paper down on the *agenda* for submission to the members on the completion of the discussion on railway lighting. Whether or not there would have been further discussion of Mr. Fowler's paper had time permitted, it is impossible to say; but, at any rate, it may be remarked that those who did speak had not a very great deal to say in the way of adverse criticism of the author's contentions. Two gentlemen—Mr. A. P. Trotter and Mr. Henry Lea—described portable photometers that they have arranged for their own use, and which are claimed to satisfactorily answer the purpose for which they are intended. Then Mr. J. E. Evered drew attention to a large installation of Kitson lamps in operation at Sunderland Station; while Mr. Mackworth Praed described, with the aid of a working plant, an invention for carburetting air with petrol. Numerous other lighting systems and appliances were also referred to. There was some diversity of opinion as to the exact position at which the illumination of a room should be measured—Mr. Lea favouring 3 feet from the ground, Mr. F. W. Goodenough 4 feet, and Mr. Fowler himself 9 inches. Among the other interesting facts elicited during the discussion, was the very small number of fires following on train wrecks that have been traceable to the gas used for lighting the carriages. The President pointed out that this did not strictly come within the scope of the discussion; but Mr. Hughes was allowed to make his statement, which was to the effect that the records of the past 26 years showed that the fires caused by gas amounted to only 0·27 per cent. of the total number of accidents. This fact, he said, should re-assure the British travelling public. Mr. Hughes protested against the prejudicing, in this connection, of such a valuable lighting agent as gas; and we must point out that the same position was taken in an article on the subject which appeared in the "JOURNAL" a few weeks ago.

London Junior Gas Association.

The London and Southern District Junior Association are certainly to be congratulated on the work they have so far accomplished during the present session. The greatly improved attendances at the meetings have naturally resulted in the papers submitted being animatedly discussed, which is, of course, both encouraging to the authors and beneficial to the members. The two visits that have been carried out were also very largely taken advantage of, as, indeed, is not to be wondered at in view of their interesting character. In point of comfort, too, the new meeting-place is everything that can be desired; so that altogether one cannot but feel that the gatherings have been rendered as attractive as possible. Under these circumstances, it would not be surprising if we had the pleasure of recording still larger attendances at the meetings as time goes on. Last Wednesday, the Association were able to make what was for them a new departure; Mr. W. H. Y. Webber having consented to deliver a lecture on "Flame Temperature in Its Physical Aspects." This was accompanied by demonstrations with various kinds of burners: and it was followed with great attention by an audience which numbered about fifty. At its close, various points were discussed, and a number of questions were asked. An interesting feature of the lecture (an abstract of which will be found in to-day's issue) was a series of comparative observations—made by Mr. A. W. Onslow, by means of the Féry pyrometer—of the radiant temperature of incandescent mantles.

An Employers' Strike Fund.

Some months ago, reference was made in the "JOURNAL" to a proposal which had been put forward by Sir John Bingham to the effect that British manufacturers should provide a guarantee fund for the purpose of combating strikes forced upon them by Trade Unions. We learn from the "Standard" (in whose columns the proposal was first made) that there is a strong probability of the suggestion taking concrete shape in the near future. Sir John Bingham himself offered to guarantee £10,000 for such an object; and it is understood that other leading firms have expressed their willingness to become responsible for equally large sums to a properly constituted fund. Indeed, our contemporary says, the proposal seems to be regarded with so much favour that it is considered probable that there will be little difficulty in establishing a fund of from £10,000,000 to £20,000,000. It should be pointed out that the main object in view is a purely defensive one; being no more and no less than to do for the employer what the Trade Unions have already accomplished for the workers—that is, provide effective means for the protection of his interests. The very fact that the idea was mooted by Sir John Bingham should be sufficient to prove this, inasmuch as he maintains the most cordial relations with his own many employees. His contention is that a masters' strike fund would in reality be to the ultimate benefit of the workers, inasmuch as it would induce Trade Unions to exhaust every means of conciliation before entering upon an industrial struggle. There would appear to be reason in this argument; for it is on the lines of the widely accepted maxim that the best method of ensuring peace is to be prepared for war. It should not be difficult to draw up an agreement between the subscribers which would prevent any possibility of the fund being used for purposes of oppression—in fact, Sir John Bingham himself suggested the conditions which might be imposed when he originated his proposal. It is stated that the advisability of creating such a fund as is here alluded to is being keenly discussed in Australia, New Zealand, and the United States.

The Seventh Annual Dinner of the Manchester and District Junior Gas Association will be held in Manchester next Saturday, and will be followed by a smoking concert.

More "Wit."—The electric light and its vagaries attract unwelcome attention at times in the columns of the daily papers. Recently, the "Tribune" wrote: The arc lamp which played "God Save the King" at the Royal Institution the other day has roused to speech a number of indignant grumblers in the West End, where electric lighting of late has been playing hide-and-seek. They ask what on earth is the use of teaching lamps these fancy accomplishments when they cannot even perform their ordinary domestic duties. If there must be music, let it, at any rate, be light opera.

Water-Gas Tar for Roads.—At the second congress on Improved Sanitary Dwellings held at Geneva last year, after such questions as sanitation, water supply, heating, and lighting had been dealt with, the development of modern methods of locomotion and the part to be played by hygienists in connection therewith came up for discussion. It was recognized that the dust caused by motor-cars must be overcome, and several tests on road-tarring had been carried out. M. Navazza, the President of a Swiss league dealing with this matter, made an interesting report. He pointed out that in the United States heavy oils had been successfully used, which were five or six times cheaper there than in Europe. In Geneva, Lambercier asphalte had been adopted, the application of which cost from 14 c. to 15 c. per square metre (about 1s. 11d. per square yard). It was put on either hot or cold; equally good results being obtained in either case. The oil coating of roads had also been tried, and had given encouraging results, especially for temporarily suppressing dust for particular events. But undoubtedly the best results were obtained with coal tar, as practically applied in France. In Geneva, the residual tar from Messrs. Humphreys and Glasgow's system of carburetted water-gas plant had been successfully used. It cost 30 frs a ton, and 1·5 kilos. of it were required per square metre, or 2·76 lbs. per square yard. M. Navazza considered it was necessary to tar all stone or macadam roads in the vicinity of towns, especially the routes most used by motorists.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 233.)

LAST week was account week on the Stock Exchange; and the prospect of lighter carrying-over rates promoted a tone of cheerfulness on the opening day. This condition prevailed through the next day. Business, however, fell very quiet; and there was little heart in it. Wednesday found dulness creeping over the markets, which not even the assured expectation of a fall in the Bank rate the next day could dissipate. The expected reduction in the rate duly became an accomplished fact; but it seemed to have little effect beyond giving something of a fillip to investment business. Things only became worse on Friday; and on Saturday they were decidedly flat—influenced considerably by the American Market, a quarter which requires careful watching for the appearance of a danger signal. In the Money Market, there was a good demand, which the supply was adequate to meet, and rates were easier. But after Thursday—when the 6 per cent. Bank of England rate (which had lasted just three months) was reduced to 5 per cent.—there was a very perceptible hardening. Business in the Gas Market was fair, although scarcely as brisk as during the week before; and the tendency was favourable. Stocks in general were firm, coupled with a nice rise here and there. Dividend announcements are now in season; and that issued by the Gaslight and Coke Company was received with satisfaction. The Company can maintain their usual rate of dividend, and carry forward a balance higher by more than £48,000 than they did this time last year. Aided by this prospect, the ordinary stock pushed its way steadily from 99¾—the opening price—up to 101, at which figure several transactions took place; and the quotation was finally marked one point up. Among the secured issues, the maximum (which partakes of the sliding-scale in a limited degree) was strong and active—changing hands at from 89½ to 90½, or a rise of one in the quotation. The preference was done at 107½ and 108¼; and the debenture at from 85 to 86. South Metropolitan was more active than it has lately been; and prices were unchanged. Transactions ranged between 128 and 129½. The debenture was active—marking from 85⅞ to 86½ *cum div.*, and from 85 to 85¾ *ex div.* Commercials were again very quiet, with two or three bargains in the 4 per cent. at 112¼ and 112½. Among the Suburban and Provincial group, Bournemouth was done at 29, Brentford old rose 2, Brighton original marked 234½—a rise of 2. British was done at 43, Lea Bridge at 122½, South Suburban at 124¼ and 124⅜, and West Ham at 104. There was less doing in the Continental Companies. Imperial advanced ½, with business marked at from 179 to 180. Union changed hands at 126¼; but European was not dealt in. Malta was done at 4½ and 4 9/16. Among the undertakings of the remoter world, Bombay part-paid was done at 5⅛ and 5¼, Buenos Ayres at 11¾ and 11⅝ free, ditto debenture at 95½, Cape Town at 14, Monte Video at 12, Primitiva at from 7¾ to 8 1/16 (a rise of ¼), ditto preference at 5 7/16 and 5 11/32, ditto debenture at 95, and River Plate at 12⅝ and 12 7/16.

The closing prices are shown in our Stock and Share List on p. 233.

ELECTRIC LIGHTING MEMORANDA.

Mr. Swinburne Explores the Metallic Filaments—The Testing and Standardization of Carbon Filament Lamps—Danger in Oxford Street—An Irate Bulletin Editor—Advice from a Contemporary.

THE past fortnight has been one in which the incandescent electric lamp has been thrust into great prominence; but the net result is not overpowering. On the 10th inst., there was a large muster of members at the meeting of the Institution of Electrical Engineers seeking hope from the lips of Mr. James Swinburne, and he (to use a commonplace), through circumstances over which he has no control, sent them away as empty as they came. He talked of the new incandescent electric lamps—that is to say, of those of the metallic filament type; and the best he could do for the seekers was to offer them a cold collation of common knowledge and truth, with an amount of personal opinion and humour sprinkled about it, to give it a little flavour. For this country, under the almost general system of electricity distribution at 200 to 250 volts, the problem that has to be faced is the making of metallic filaments sufficiently fine to enable lamps of the newer type to be used with such pressures, notwithstanding the low specific resistance. The newer lamps are all made, through physical limitations, for low voltages; and people in this country are not likely to use them in series to any great extent, or to accommodate the pressures to them. Mr. Swinburne seems to think that people's ideas of the value of light will alter, and that incandescent gas-lamps or large metallic filament lamps will soon lead them to use 50 candles as the normal light at each point. But the perfect metallic filament lamp of 50-candle power that can be used under all conditions has yet to be found. What, however, users of incandescent electric lamps are clamouring for, is not only improved and constant light, but a reduction of their lighting bills. The adoption of 50-candle power lights at one point with electricity would confine users to the high consumption and, so far as can at present be seen, perpetuate their heavy accounts. With electricity, they have not the power that the gas-tap gives them, of diminishing or increasing consumption and light at will within the limits set by the burner employed. The low power carbon filament lamps give consumers somewhat similar control by reducing or increasing the number in use; but this could not be done without disastrous consequences with the new metallic filament lamps under the prevailing pressures, nor with units of 50-candle power. When flat-flame gas lighting was the vogue, complaint was rife as to the heaviness of accounts. The incandescent mantle gave relief from this, not only by producing greater efficiency, but by reducing cost. And electricity consumers hope to see history repeating itself; but it looks a forlorn hope. The Electrical Press appear to be unanimous in not agreeing with Mr. Swinburne's opinion that the consumer will pay no attention to cost, so long as he gets greater efficiency.

Mr. Swinburne summarizes the characteristics of all the metals known to have been tried in developing the new lamps; but melting-points and specific resistances set impregnable bounds to practicability in securing lamps that can be used independently, as the carbon filament lamp can be with voltages of 200 to 250. Mr. Swinburne discussed alloys; but alloys generally have low fusing points, though it may by further research be found possible to form alloys of high melting-points. Alloying, too, has a possible disadvantage in reducing the resistance-temperature coefficient, whereas rise in resistance is a most valuable property in a wire lamp, as it protects the lamp against over-running, and allows it to be run bright on a more variable supply current. Therefore some more information is wanted before it can be accepted that the 32-candle power Zircon-Wolfram lamp (to which the "Electrician" this week calls special attention) will render good service on circuits of 200 to 220 volts, seeing that it is believed to be made of an alloy of zirconium and tungsten. We may have an opportunity on another occasion of looking into other points of Mr. Swinburne's paper on the present unpromising situation of the metallic filaments. Generally, what he has been showing is that the new lamps are of little value for this country, but electricians are urged to go on expecting, for science cannot have yet exhausted itself in this direction. If hopefulness is not a strong feature of the paper which was prepared by this buoyant spirit of the electrical industry, it is not by any means devoid of interest for the gas industry.

So much for the metallic filament lamp. The carbon filament lamp has also raised its much-abused head during the past week. With all its faults, the electrical industry is perforce bound to love it still. The Engineering Standards Committee—after much weary waiting—have issued the specification for carbon filament lamps; but we are not sanguine that it will do much good. A standard specification is one thing; compliance with it is another. The rules and regulations, it is noticed in the first place, have a tender leaning towards the National Physical Laboratory; for it is provided that the "British light standard shall be the 10-candle power Harcourt pentane lamp at the National Physical Laboratory." Why the lamp at the National Physical Laboratory? The secret comes out when it is seen that it is from this example of the standard lamp that carbon filament "secondary standards" are to be obtained. So that the object is to give the establishment at Bushey business in the provision of secondary standards, and so introduce another opening for inexactitude in the ratings of electric lamps. In the gas industry, the 10-candle Harcourt pentane lamp finds place in all gas-works laboratories worthy the name; and direct tests are made of lights without the introduction of secondary lamps that cannot be checked without sending them away for the purpose. There is nothing in the lamp at Bushey that should make it superior to any other 10-candle pentane lamp. The National Physical Laboratory in this matter is, there is no doubt, doing its level-best to get the electrical industry under its wing for revenue purposes; but if a gas-works can afford to have a standard pentane lamp, and the manager and assistants all fully qualified to use it (photometry being part of their technical training), surely the manufacturers of incandescent electric lamps would do better by themselves dealing direct with the pentane lamp than by being dependent upon the National Physical Laboratory. There is nothing secret, terrible, or difficult about the standard pentane lamp that it should be necessary to make the distance between it and the markings on carbon filament lamp bulbs any greater than between the works' own laboratory and the shop where the inscriptions are made.

That is one point; the question as to the consumer procuring lamps of greater uniformity in performance and with the nominal valuations of lamps real and not fictitious is another. But who is to come to the aid of the consumer in this matter? It is all very well for the Standards Committee to say that the useful life of a lamp is completed when the mean horizontal candle power has dropped 20 per cent. But who is to stand over the consumer to tell him when his lamp has fallen the 20 per cent. in mean horizontal candle power? The prescriptions for the making of the lamps do not concern us; but the results do. In the prescribed tests, it is noticed that the "average" limits within which results may fall are 8 per cent. for the candle power, and 5 per cent. for the total watts; but individual lamps are allowed 60 per cent. greater latitude. These are fairly benevolent "average" limits. The life tests are also to be carried out on a circuit whose voltage is never more than ½ per cent. above normal; the pressure being adjusted at the start so that the lamp is burning at its standard efficiency. Those are not the same conditions as the irregular ones the consumer meets with; so that, except to enable him to start with lamps that are more consistent than those he buys

at present (that is, if he is certain of obtaining lamps that comply with the specifications), he will not realize much, if any, benefit from their use above what he obtains from the good class lamps at present. It is noted that, in a table of standard efficiencies, the watts consumed per hour per candle power per 8-candle power lamp, with a life of 400 hours and at 110 volts, are 3·25, and at 220 volts, 3·90 watts. For an 8-candle power lamp, with a life of 800 hours, and at 110 volts, 3·75 watts; at 220 volts, 4·50 watts. For a 16-candle power lamp, with a life of 400 hours and 110 volts, 3·10 watts; and at 220 volts, 3·70 watts. For a 16-candle power lamp, with a life of 800 hours, and at 110 volts, 3·50 watts; and at 220 volts, 4·10 watts. These are "standard" efficiencies, which will not be maintained in practice. But they show we have not in the past been acting unjustly in taking an average, under consumers' conditions, of 4 watts per hour per candle. It is easy to express agreement with the frank remarks on this subject of the "Electrical Review." "It is well known," says our contemporary, "that 220-volt lamps of 16-candle power, reputed 60-watt lamps, take anything from 70 watts upwards during *their brief lives;* and they *vary widely in candle-power.* Consumers are entirely at the mercy of dealers [our contemporary should have added "and central supply stations"], except in the rarest instances, and all sorts of abominations are supplied to them, whether in good faith or not is immaterial. . . . No wonder that consumers who are paying for 16 candles and receiving 8 are restive, and even rebellious, or that the gas interests are recovering lost ground."

No one will envy the Marylebone Borough Council the possession of their electricity undertaking. What with the enormous capital expenditure, the supply breakdowns, and the opposition the plans for the lighting of Oxford Street have evoked, existence must now for their Electricity Committee be almost unendurable. They would have had less occasion for worry if it had not been for those centrally placed lamp standards in Oxford Street. They are perfect *bêtes noires* to those who have at heart the interests of London traffic and the safety of the public. The London County Council have had a shot at them; and their action has the support of the report of the Royal Commission on London Traffic. Now it is the Roads Improvement Association who are attacking the Marylebone Borough Council on the same grounds. The obstruction caused by lamp standards down the middle of roadways has been recognized by other local authorities in London; and only recently the St. Pancras Borough Council have been, at considerable expense, removing those in the Marylebone Road. The Roads Association protest against the obstructions in Oxford Street, and against the danger that threatens the public by having the standards in such a situation. The Local Government Board have been appealed to; but they have replied that the matter is not one in which they have any authority enabling them to intervene. The Borough Council have now given the Gaslight and Coke Company notice to discontinue the gas lighting; and the business people of Oxford Street are beginning to realize that the danger of the centrally disposed standards will be vastly increased, when the gas-lights no longer exist, and when, without warning, the electric lights suddenly collapse at busy hours, as the interior ones have recently been doing. With the electric light aiding and sheltering by its vagaries, Oxford Street will become the resort of more undesirables than the shopkeepers there will care about. The "Lancet" has also been complaining of the seriousness of these failures from the point of view of the medical specialists and others in the Marylebone district.

The Editor of the West Ham Electrical Bulletin has been sorely hurt by our article on "Gas and Electricity *vis-à-vis* at the West Ham Town Hall," published on Nov. 27 last. He describes it as "a most abusive, unfair, and vulgar tirade against the West Ham Electricity Department," our methods are compared to those of "saffron journalism," and we are accused of "coarse abuse." Judging by the standard applied to our article, this writer surely could scarcely find language strong enough to describe these particular efforts of his own. We are not quite certain, however, that the Editor of the West Ham Electrical Bulletin, in his great wrath, quite knew, when writing his notes, the full import of the words he was using, nor did it apparently occur to him that he was exposing himself to the liability of having to seriously justify those words. If he has cooled down by this time, we will give him an opportunity of pointing out in the columns of the "JOURNAL" where the article in question (which was the result of a visit to the West Ham Town Hall) was "vulgar," contained "coarse" abuse, and savoured of "saffron journalism." There he has three distinct points on which to give explanation; and if he cannot make a satisfactory defence, perhaps he will ultimately come to the conclusion that argument and fair criticism in journalism—amateur or otherwise—are better than scattering about epithets that carry personal reflection. The Editor of the juvenile "Bulletin" can be a jocular fellow as well as an angry one; for he also protests against the "vilification of matters electrical." The humorous side of this is great when the contents of samples of earlier "Bulletins" that have reached us are remembered. There is little doubt that it is a good thing our reputation does not depend alone upon the estimation accorded to it by the person responsible for the paragraphs in question in the West Ham Bulletin. We await his justification. Meantime—in view of further reflections upon us in which Mr. Dugald Clerk's address, at the last meeting of the Society of British Gas Industries, was concerned—perhaps it will interest the writer to learn that a verbatim report of that address appeared in the same issue of the "JOURNAL" as the offending article. It is rather peculiar that this should have escaped his attention, and that the fairness of our report was not acknowledged by him. But perhaps the excuse must be made that vision is often obscured by anger.

Our weekly contemporary "Electrical Industries" in its last issue addresses a little gratuitous advice to us anent our attitude in connection with municipal trading in electricity. The gist of the advice is that we should keep silent on the subject; for the best way of killing municipal electricity supply is to let it pursue the present suicidal policy. The advice would be good if it were not that municipalities have the rates and the public lighting to fall back upon *ad lib.* to support and conceal their maladministration, as well as many opportunities for shifting responsibility on to other departments. Gas undertakings happen to be large ratepayers and competitors. Increasing rates affect them considerably; and rate-aided competition is not competition on level terms. Our contemporary states how perfectly willing it is that the "JOURNAL" should "assist" them in discouraging municipal electricity. We suppose that deep gratitude for this honour ought to be felt by us; but what our feelings are we will not divulge. Meanwhile we have an idea that this is a case in which discouragement by silence would be a painfully long business; and therefore any part that we can take in agitating for the proper and business-like conduct of municipal electricity undertakings will not be neglected.

LAMP TESTS FROM THE WESTMINSTER ELECTRICAL TESTING LABORATORY.

WE have received from Mr. Lancelot W. Wild, M.Inst.E.E., of the Westminster Electrical Testing Laboratory, three volumes whose diminutiveness cannot be regarded as in any way reflecting the amount of work that the compilation of the contents has involved. The contents comprise a very large series of tests on the illuminating power, consumption, and life of some of the principal makes of incandescent gas-burners and electric lamps, other than ordinary or flame arcs.

In a covering letter by Mr. Wild, he says that "the tests fulfil two useful purposes. They show first of all the relative merits of different makes of lamp, whether gas or electric; and they also serve as a true basis for the calculations of the respective costs of gas and electric lighting." A criticism of the volumes is shorn of some of its effectiveness as we are prohibited from making use of the figures exhibiting the results of the tests. But so far as the results of the tests of the incandescent gas-burners and mantles are concerned, we must join issue with Mr. Wild in regard to any useful purpose whatever being fulfilled by them. In the first place, in considering the relative value of tests of this description—whether of gas or electric lamps—it must be remembered that, in laboratory tests, the conditions of common use in the best manner available to consumers are never or rarely ever reproduced, so that for cost comparison the results are really of little value. In these particular tests, too, the electrical lamps appear to have received all the refinement that a well-equipped electrical laboratory could possibly offer; while the gas-burners were not treated with the slight courtesy that they demand to produce the most valuable return in service. In the second place, tests made with the gas supplied by the Gaslight and Coke Company can be of very little value, for comparative purposes, in districts where gas of other qualities is distributed, under probably different pressures, and without carburetted water gas, or with carburetted water gas in differing proportion and richness. The tests of the gas burners and mantles as made by Mr. Wild can only have an academic interest, more especially as there is nothing to satisfy, but plenty having an opposite suggestiveness, that they were not carried out in a most crude and unscientific manner. The tests ranged over 500 hours, during the whole of which time the gas consumption remained constant for each individual burner; and, as nothing is said to the contrary, we may assume the air supply to the burners remained constant. A more unjust condition in connection with any bunsen burner used for incandescent purposes could not obtain. The composition and pressure of the gas may vary several times during a run of 500 hours; and the condition of the burner itself changes.

Therefore, to get the best results from the burners, both the gas and air supply require occasional adjustment. It is the practice of the consumer, each time he lights his burner, to turn his tap until he gets what he judges to be the maximum illumination from the burner; and it has also become the common practice of the consumer to use the means of air regulation now provided with all burners worth consideration. There we have, in daily use, adjustment of the gas and primary air supplies. By limiting the burner to constant conditions of use, it is impossible to do it justice or get an approximately uniform illumination; and this elementary fact the ordinary gas consumer appears to appreciate better than the testers at the Westminster Electrical Laboratory. Again, we are told that the chimneys were not cleaned during the period of the tests—lasting 500 hours! We cannot see the reason for this. It is the misfortune of the incandescent electric lamp that the consumer cannot clean the inside of the lamp bulb; but no gas consumer would permit—if he has any regard for cleanliness, or for maintaining the constancy of his lights—his lamp glasses to get into,

or remain in, a dirty condition. Then, again, we read that the nipples of the burners were cleaned repeatedly; but the experimenters say nothing whatever about the removal of the mantle and the cleaning of the gauze cap from dust. Truly more science is brought to bear by the ordinary consumer in dealing with his gas-lights than was exercised by the electrical photometrists at the Westminster Testing Laboratory in carrying out these tests. It is one of the great advantages of the incandescent gas-burner that it puts into the hands of the consumer conveniences for ready adjustment and cleaning, such as the electricity consumer does not possess, for the maintenance of constancy of light. And in any scientific tests therefore, no one but a tyro in gas-burner testing would surely refuse to give the burners the benefit of any superiority in respect of means for light maintenance.

With these preliminary objections, let us turn to the tables of figures; but we are cut short by the prohibition as to quotation. The figures show the total candle power, the consumption (constant, be it repeated, for each individual burner throughout 500 hours), and the illuminating power per cubic foot. In this connection, it will interest readers to know that the candle power was measured by a Wild flicker photometer; an electric lamp being employed as a comparative sub-standard. The comparison lamp was on each occasion checked against a Wild-Stearn standard incandescent lamp. The standard lamp was also checked against eleven other standard lamps at the commencement and on completion of the tests. So that the Westminster Electrical Testing Laboratory employs means of conducting tests that are peculiar to itself, and are not comparable with the statutorily prescribed and recognized appliances and methods of the gas industry. Without procuring the same photometrical paraphernalia as used at the laboratory, no one could ascertain how the types of burners and mantles used, tested under his own conditions, would compare with the really peculiar results shown in the figures in the tables. It will further interest men acquainted with photometrical work on incandescent gas-burners, to see that these tests ascribe to a Welsbach-Kern burner at the start a lower efficiency per cubic foot of the 16-candle gas of the Gaslight and Coke Company than was obtained from an ordinary Welsbach "C" burner. The strange manner in which the candle power per cubic foot of gas consumed widely varies with the same burners and the same types of mantles ought to have shown the observers that there must be something wrong in their treatment of the individual subjects under examination. Had the figures been even superior to those that we think ought to have been realized, and had the extraordinary discordance shown by these figures obtained with the same make of burners and mantles, we should still have rejected them as being unworthy of credence and acceptance. The names of the burners and the mantles are given at the top of each table; and we are afraid that when the tables get into circulation, the makers of some of the burners will, notwithstanding that the books are marked "Private and Confidential," be calling upon the Westminster Electrical Testing Laboratory to substantiate the figured assertions, which are, in most if not all cases, totally opposed to all preceding work in the same direction. The light tests for constancy are vitiated by unfair—"unfair" because it is not the common—treatment, and possibly also by the instruments and methods employed, supplemented (we will not say it is so, but will again say possibly) by a little natural favourable inclination towards those things that are electrical. In making this remark, we do not impeach the honesty of those who carried out the tests; but we do say the results of those tests are, on the face of them, disentitled to respect. Of course, incandescent gas-lights will show a gradual depreciation in illuminating power in 500 hours if they are not given occasional attention; and therefore, under negligent conditions, what is the good of the mean candle powers of all mantles throughout 500 hours? We can get higher mean illuminating powers by the exercise of the advantage of regulation that the incandescent burner gives us. Therefore it is impossible to endorse Mr. Wild's opinion that such figures as he presents are the "true basis of comparison between the rival makes of lamp, burner, or mantle."

The second volume comprises tests carried out on 200 volt, ½ and ¼ ampere Nernst lamps, 100 volt Tantalum lamps, and 100 volt, thirty watt Osram lamps. The third volume includes tests carried out on twelve different makes of carbon filament lamp.

We have already acknowledged the vast amount of work represented by these three small volumes. Measured by the time expended on the work, the volumes are well worth the three guineas (or 21s. for each volume) asked for them; measured by the value to the purchasers, if the desire is to compare between gas and electric lighting, we should certainly say the volumes are not worth the price asked. Independent tests made under normal conditions are of value; but such independent tests must give to the burners the best that can be obtained from them, by treating them as they are made to be treated, and by avoiding such crudity as we have pointed out. One commendation for the volumes is that they are neatly bound in leather, and are supplied with a protecting case. It is a question whether there has not been a little extravagance in putting the results of the gas-burner tests in such rich dress, for the binding is certainly the best part of that particular volume.

Mr. G. Shepherd, J.P., of Bacup, who was Chairman of the Rossendale Union Gas Company, left estate of the gross value of £170,963.

SOCIÉTÉ DES INGÉNIEURS CIVILS DE FRANCE

Presidential Address of M. Emile Cornuault.

We heartily congratulate M. Cornuault upon the distinction that has just been conferred upon him—and through him upon the gas industry—by electing him President for this year of the French Society of Civil Engineers. We do not remember that such an honour has ever previously been bestowed by civil engineers, either in England or in France, on an engineer who has devoted himself to the gas profession. We therefore rejoice that at last a representative Society of Civil Engineers has selected a gas engineer to occupy its presidential chair. No better selection could have been made than that which the French Institution of Civil Engineers has made; for M. Emile Cornuault has long been prominently connected with the Society, and as a gas administrator has achieved a reputation beyond the borders of his own country. In gas circles in England, he has reason to be particularly well known, for many and oft have been his professional visits to this country; and he has given especial attention to the gas affairs of London. In 1883, M. Cornuault contributed a paper on "The Gas Companies of London," both to the Société des Ingénieurs Civils and to the Société Technique du Gaz, who met that year at Marseilles. On the happy occasion of members of the latter Society visiting us at Brighton and in London in July, 1901, just after their annual congress at Dieppe, an abbreviated and amended reproduction of this paper was distributed, and proved of great interest and value to our visitors in understanding the gas affairs of the Metropolis. In the absence of that year's President of the Société Technique, it was fortunate that M. Cornuault was available to take the lead in representing his Society over here; and how well he did it, at Brighton, Earl's Court, Greenwich, and elsewhere, will be remembered by all present on those occasions, and as to which the columns of the "Journal" at the time afford every evidence.

M. Cornuault commenced his gas career with the Marseilles gas undertaking, rising to become the Manager, and later on the Managing-Director. Elected a member of the Société Technique du Gaz in 1874, he afterwards became the Secretary, then Vice-President, and President in the year 1889. This was the year of the Paris Exhibition; and it fell to M. Cornuault to welcome the English gas representatives, prominent among whom was Mr. Charles Hunt, who is once again the head of the English Gas Institution. M. Cornuault has also taken an active part in, and has been President of, the Syndicat Professionel de l'Industrie du Gaz, which looks after questions relating to the gas industry, but not of a scientific or a technical character. He has done a great deal of work at various times in connection with Parisian gas questions, and has received the Légion d'honneur for "exceptional services rendered to the City of Paris." Some of these facts and qualifications were pointed out by the retiring President of the Société des Ingénieurs Civils (M. Hillairet), when inducting M. Cornuault to the presidential chair at the Society's meeting on the 4th inst.

The Presidential Address.

The new President, in his opening remarks, gracefully alluded to M. Hillairet as "a man universally appreciated in the engineering world," and paid a high tribute to his work and character. Proceeding, he said it was chance rather than malice, that had led to a gas engineer being chosen to succeed an electrician in the post of President; and if it was intended by their two names to symbolize the union of the two industries, which were formerly rivals, they had been successful, for never had there been a more sympathetic collaboration than had united the President and the Vice-President, the predecessor and the successor.

Artificial Illumination before Gas.

Lighting was of interest to all mankind. When the sun dropped behind the horizon, civilized man, so as to replace daylight and extend the conditions of social life, had recourse to artificial illuminants, the number and power of which were to-day continually increasing. In fact, no limit could be assigned to them other than the clearness of day itself, though that limit was sufficiently far off if, as in the old works of Bouguer and the more recent calculations of Fontaine, it was reckoned that the amount of sunlight in a city like Paris, for instance, represented more than 10,000 times the whole artificial lighting now used in the French Capital. It might therefore be truly said that the scope of lighting is indefinite. Also it may be said that lighting is essentially modern. From the most remote times up to nearly the end of the eighteenth century, there was not any progress to speak of from one century to the other, although artificial illumination seems to be contemporaneous with human existence. From the beginning, men sought to prolong their labours beyond the time afforded them by the light of the sun; and without doubt, wood fires formed the first method of dissipating darkness. From this, one passed to the resinous wood torch, then to the Roman lamp, formed of a vessel pierced with a hole through which the wick plunged into the oil; and so to the wax candle, which was the luxurious light of the Romans. Later on came the candle, properly so-called, the tallow candle, the use of which is the most extended through the centuries. Tallow candles for the poor, wax-candles for the rich—such has been the only illuminating material of our ancestors. Its

consumption has increased; but the system remains the same. It was only in the second half of the eighteenth century that the oil reflecting lamp appeared, and in 1784 that the invention and exploitation of the argand oil-lamp, with a double current of air, distinctly marked the point of separation between ancient and modern lighting.

Characteristic Periods of Lighting.

From this period, in a few lines, may be given the succeeding stages.

1800–1820.—Improvements in the argand lamp, Carcel and Gagneau oil-lamps, and, above all, in lighting by gas, the invention of Philippe Lebon, with whose name must be associated those of Murdoch and Winsor.

1820–1840.—It was only after 1830 that lighting by gas practically established itself—that it transformed the public lighting of towns, and at the same time came little by little to revolutionize interior lighting of houses. At the same period, a considerable difference was brought about in inside lighting by the invention of the stearic composite candle, made commercially by De Milly from 1834, who thus gave a fatal blow to the wax candle.

1840–1860.—Development in the foregoing lights, and especially in gas lighting, which at the end of this period (1855) received a new impulse by the fusion of the different gas companies lighting Paris into one powerful company.

1860–1870.—Outside the development of gas lighting, which continued, this period is marked by the appearance of the mineral oil-lamp burning petroleum discovered in the United States, and imported into Europe after 1861. The cheapness of petroleum, the absence of any mechanism in the lamp using a volatile liquid, and consequently the simplicity, and low price of the petroleum lamp, allowed of its rapid development, and entirely modified private lighting, especially among the labouring classes.

1870–1880.—This period is marked by the entrance into the first rank of a source of illumination—the electric light—which has created a new era in the art of lighting, continuously raised its level, and strongly stimulated rival methods of lighting. It was in 1878 that the Jablochkoff lamp made its appearance in the Avenue de l'Opéra, giving the electric light a start which could not be stopped, and which was soon followed by the incandescent electric lamp in 1880. Lastly, after the electric light, we have yet to record the new inventions of acetylene, carburetted gas—long before known, but the manufacture of which was not practical before 1894, at which time carbide of calcium had been made in the electric furnace. Acetylene, by reason of its great illuminating power, and the essentially portable character of its producing apparatus, is of real value in a number of special circumstances. This rapid survey is sufficient for you to take account of the course that has been traversed during a century.

Flat-Flame Gas-Burners.

Turning to the subject of progress in gas lighting, M. Cornuault mentioned that it was on Jan. 1, 1829, that the first gas-burners were installed (in Paris) on the public thoroughfare—in the Place du Carrousel, and afterwards in the Rue de la Paix, &c. In 1835, there were 203 gas-burners in the whole of Paris; in 1839, there were 1162 gas and 11,654 oil burners; in 1848, 8600 gas and 5880 oil; in 1852, 13,733 gas and a few hundred oil burners. The gas-burners generally used were of the batswing type, enclosed in lamps and giving a flat fan-like flame. These burners were classified in 1843 by Fresnel, thus:—

	Consumption. Litres.	Lighting Power. Carcels.	Consumption per Carcel. Litres.
Batswing burners, 1st series ..	100 ..	0·77 ..	129
,, ,, 2nd ,, ..	140 ..	1·10 ..	127
,, ,, 3rd ,, ..	200 ..	1·72 ..	116

Besides the slit batswing burner, the candle (or jet) burner was used; then a burner with glass chimney and double current of air—in imitation of the Argand lamp, later on known as the Bengel burner. The latter has been very minutely described by Dumas and Regnault, in their classic instructions, and it is used for tests on the gas in Paris and elsewhere. The standard burner gives the carcel for an hourly consumption of 105 litres of gas. Of course, more powerful burners were made, but rarely higher than 200 to 300 litres of consumption, and so of 2 to 3 carcels in power.

Intensive Burners.

Such was the situation, when, in 1878, the electric light (the Jablochkoff candles) appeared in the Avenue de l'Opéra. Gas engineers were rather agitated—why should they not own up to it?—and exerted themselves to show that with gas they could do as well, even if not better, and at less expense. This profitable ambition was encouraged by the City of Paris, which in 1879 gave over the Rue du Quatre-Septembre, near the Avenue de l'Opéra, to the Gas Company as an experimental quarter. The first idea was to group several flat-flame burners in the same lamp; and it was thus that arose the intensive burner known as the "Quatre-Septembre," which made a sensation at the time. It was composed of six large slit-burners of 6-10ths of a millimetre, each consuming 233 litres (8·228 cubic feet) of gas per hour, or a total of 1400 litres (49·444 cubic feet), arranged on a circle 16 cm. ($6\frac{5}{16}$ inches) diameter. This burner, a kind of decorative fire-vase, gave an intensity of about 13 to 14 carcels. The comparison between the intensive gaslighting in the Rue du Quatre-Septembre and the Jablochkoff electric burners in the Avenue de l'Opéra may be shown as follows:—

Gas . .	0·15 carcel per square metre;	cost per hour 14·56 fs.
Electricity .	0·05 ,, ,, ,, ,, ;	,, ,, ,, 19·20 ,,

The advantages lay very much with gas, and the Jablochkoff lighting temporarily disappeared from the Avenue de l'Opéra in the year 1882.

Before the success of the 1400-litre intensive burner of the Quatre-Septembre, another type of the same class, but of 875 litres, had been made; and, by the report of M. Cernesson, in December, 1878, to the Commission of the Municipal Council, the establishing of these new burners was authorized. So that, for example, the amount of light in the Rue du Quartre-Septembre was increased in the proportion of 4·2 to 112, and in the Place du Château d'Eau of 10·7 to 80. The first benefit, then, of the electric light was considerably to increase the amount of light distributed on the public streets. The free air intensive gas-burners continued to extend during the following years, and in Paris there were: In 1882, 279 burners of 875 litres, and 466 of 1400 litres; and in 1888, 379 burners of 875 litres, and 1126 of 1400 litres. But in the meanwhile, hot-air regenerative burners made their appearance, and after some years of experimenting, succeeded in replacing, little by little, the cold air intensive burners which ended by disappearing almost entirely.

Regenerative Burners.

The first hot-air burner is due to a Frenchman, Chaussenot, who showed the advantage accruing from raising the temperature of the air supplying the combustion of the gas of a burner from the point of view of increasing the resulting illuminating power. As far back as 1836, he obtained a prize from the Société d'Encouragement for his lamp, combining, as the report said, "the most effective means for increasing the illuminating power of flames produced by the combustion of gas." But it was not until much later, in 1879, that Herr Frederick Siemens, adopting the fecund method of recuperation for heating the air (already applied to industrial heating), rendered practical Chaussenot's idea, and formed the regenerative intensive burner, which had its period of success. I had the honour of showing the first Siemens burners introduced into France to the Société des Ingénieurs Civils twenty-six years ago (on Jan. 21, 1881), and of explaining the principles upon which they rested. It will suffice for me briefly to remind you that it is to the incandescence of the particles of carbon given off by the decomposition of carbides of hydrogen that is due the illuminating power of gas; and that the particles of incandescent carbon give more light if they are carried to a higher temperature. It is an analogous phenomenon which is observed in incandescent electric lamps. When they are, as is commonly said, "pushed," they give more light and a whiter light—the light restricting the more refrangible rays. Therefore, to obtain a higher temperature of flame, Siemens heated the air necessary for combustion, by utilizing or recuperating for this purpose the lost heat of the products themselves of combustion. Within practical limits—that is, between 0° and 400° or 500°—the yield was improved, according to the experiments of M. Sainte-Claire Deville, by about 20 per cent. for each 100° the temperature was raised. It was under these conditions that the following principal types of regenerative intensive burners were made:

	Carcels.		Litres per Carcel.
Burners of 350 litres hourly consumption, giving	5 to 6	or	70
,, ,, 700 ,, ,, ,, ,,	13 to 14	,,	50 to 60
,, ,, 900 ,, ,, ,, ,,	20 to 22	,,	40 to 50
,, ,, 1600 ,, ,, ,, ,,	40 to 45	,,	40 to 50

It showed, therefore, both from the point of view of economy in consumption and power in production, considerable progress for the time.

These burners came into general use especially in Germany; but the unsightly form of the regenerators, the difficulty of disguising the side chimney, &c., prevented them from being seriously adopted in France, in spite of the trials made, in 1882, in the Place du Palais-Royal, and, in 1883, in the Rue Royale. It was only when the manufacturers, by placing the regenerator in the upper part, gave the flame the shape of a tulip burning in a glass cup suspended from the regenerator, that the regenerative burners extended to private lighting (1882-1885) under the names of Cromatie and Wenham burners. As for their application to public lighting, the Siemens burners always remained defective, until, in 1884, under the name of Schulke burners, new and improved Siemens burners, with regenerator above the flame, were introduced into France. The regenerator was constructed of nickel, the maintenance was less costly, and improvements in detail were made. In short, Siemens burners, and then competitive burners (Industrial, Parisian burners, &c.), were, about 1887, economical and remarkably powerful appliances for public lighting. Schulke burners of 750 litres, put up in 1887 in a Paris thoroughfare, gave 17 to 18 carcels; thus giving the carcel for 40 to 45 litres. They replaced, notably, the cold-air intensive gas-burners of the Rue du Quatre-Septembre, which consumed, as we have said, 1400 litres of gas per hour to give only 13 to 14 carcels. The number of regenerative burners on the Paris streets has been as follows: In 1889, 27; in 1891, 1444; in 1893, 2169; in 1898, 3570; and in 1899, 212. The decrease in the number after 1898 sufficiently shows that new facts had arisen in the interval—it was, indeed, that incandescent gas-burners, by the

discovery of the genius of Auer, began, starting from 1892, to work an absolute revolution in lighting by gas.

Early Incandescent Gas-Mantles.

The principle of incandescence had been known for some time. All solid refractory bodies, heated to a sufficient temperature, become incandescent, and the whole problem consists in reaching the necessary temperature under conditions obtainable in practice. The first application of incandescence was known under the name of the Drummond light, and dates from 1826; it was obtained by making a lime rod red-hot by means of a mixture of hydrogen and oxygen. Later, in 1849, Frankenstein, who seems to be the real precursor of Auer, brought to incandescence a woven gauze-net, previously steeped in a rather thick pulp prepared with equal parts of finely broken chalk, calcined magnesia, and water with gum arabic. He thus obtained, and introduced into the flame, a cone which we to-day call a mantle, and which he called a "multiplicator of light." Frankenstein gave the precise details word for word as follows: "The texture is immediately charred; at the end of some time the carbon burns and the earthy oxides only remain in the form of the original gauze; the cone is not long in becoming an intense red-white." I have thought it well to bring before you this exact quotation, which is truly striking to-day, and justifies what I have said before as to the precursory rôle of Frankenstein, which should not be forgotten.

In 1869, Tessié du Motay and Maréchal took up again the idea of Drummond, and in the Place de l'Hôtel-de-Ville, had a trial of the light, called oxhydric. This was, in fact, nothing else but the Drummond light, in which hydrogen was replaced by coal gas, and the lime rod by a pencil of compressed magnesia or of zirconium. Then, in 1882, Clamond introduced a mesh, or basket, formed of drawn-out magnesia, combined with a certain proportion of zirconium, into the flame of a burner with a double current of air. Profiting by Siemens's invention, he did not overlook the previous heating of the air of combustion, thus raising the temperature of the incandescence. The action of the burner was really satisfactory, and the Clamond burner, reversed or not, had its hour of success; but the basket was fragile, and its life ephemeral. There still remained to be discovered a sufficiently strong mantle, though without bulk, and becoming incandescent at a comparatively low temperature. All the bodies tried up to Auer had too great a mass, and were not susceptible of being brought, under usual conditions, to the necessary temperature in order to arrive at their illuminating incandescence. However that may be, the problem of incandescence has been really solved only by the invention of Dr. Carl Auer von Welsbach, of Vienna, formerly a pupil of Professor Bunsen at the University of Heidelberg, who brought to the gas industry a weapon of the first importance, of which it had begun to have great need—let us recognize it—in order to confront the continuous progress of its young and brilliant rival, electricity.

(To be continued.)

Société Technique du Gaz en France.

A circular-letter, dated the 14th inst., and signed by M. Coze, this year's President, reminds us that the next annual meeting of the French Gas Society will be held at Nancy on the 11th of June and following days. The last date for the sending in of papers is the 11th of May, though members are asked to advance this date if possible. We are pleased to find that the date of the French congress will not clash this year, as it did last, with the meeting of the Institution of Gas Engineers—more especially as this year's meeting in Dublin is to partake of something of an international character. A new departure is being made by the Society, and a special circular has been sent out concerning it. To make the technical gatherings at the congress still more interesting, a special meeting will be reserved in the future for a series of general discussions on questions decided upon beforehand. Everyone will be able to express his own opinion on these chosen subjects, and can mention to his colleagues the processes or practices he has adopted in analogous cases to those being considered at the time. Members are asked to state now what questions they think should be discussed at the Nancy meeting. The subjects which are suggested by the greatest number of members, and which present problems of urgency or of actual practice, will be announced in due time for consideration. We welcome this new proposal, and trust and believe that it will add to the practical importance of the work of the annual meetings, and prove of real assistance to many members.

Scottish Junior Gas Association.—The members of the Western District Section of this Association will visit the fire-brick and retort works of Messrs. Dougall and Sons, Bonnybridge, next Saturday, when Mr. E. M. Stewart, the Manager, will read a paper entitled "Fire-Bricks and Retorts." At the close of the visit, the company will be entertained at tea by the firm.

"Punch's" Suggestion to Marylebone.—Among the Charivaria in the current number of "Punch," there appears the following paragraph, which contains what may prove a useful hint to the Marylebone Borough Council: "There has been a further failure of the Marylebone Council's electric supply; and it is suggested that the Council might make a handsome profit by selling candles for use on such occasions."

THE TREND OF GAS INVENTION.

In making our usual review of the abstracts of patent specifications that were published in the "Journal" last year, a point that first obtrudes itself upon one's notice has quantitative significance. It is not many years ago when the total of the abstracts published by us in a year was, with notable consistency, somewhere in the neighbourhood of 200, and then, in the smaller quantity, there was not the same necessity as now for discriminating between the specifications of the useful or promising and those that are of small account—many obviously only being what may be termed protectors of minor details. This weeding out notwithstanding, the last four years have seen a very considerable increase in the number of specifications that have been dealt with; and although there has been no intention of getting any numerical concordancy, it is interesting to observe how closely the specifications dealt with year by year have had numerical similarity. In 1903, 310 gas specifications were dealt with; in 1904, 298; in 1905, 322; and in 1906, 310. It was in the years preceding that the totals receded considerably from these figures.

Carbonization and the Means—Recollections of the Grice Drawer-Charger.

First taking those specifications falling within the carbonization department—that is to say, including gas production to the hydraulic main, and coal and coke plant—the number summarized and illustrated during the year reached 42, of which only 14 were importations. Analyzing the subject-matter of the specifications, nearly everything is found to be dealt with within the limits of this section. There has been what may be described, for these times, as a considerable amount of attention given to the heating of retort-settings. At least five specifications have been published that exhibit this purpose. Though they appear under a variety of descriptive headings, their intention has relationship. One inventor twice directs attention to the gas and air passages of regenerative furnaces and the tiles used therein; and another aims at a "better distribution of the producer gas and secondary air over the whole length of the combustion chamber." From abroad came proposals for the "regulating" of the temperature of retort-ovens; and one treating of the heating of retorts of great length. In connection with ordinary retorts, there was a novel home plan described for making two or more retorts in one piece — among the advantages claimed being economy in space, improved and more regular heats, increased life, and economy in ironwork. With a view to increased structural strength, there was a proposition for making the heads of retorts with a solid end piece, forming part of the masonry of the bench. This was a suggestion from abroad. Before leaving the ordinary horizontal system, the activity in the production of new charging and discharging arrangements should be noted. Machines operating from both sides of retort-benches have, over the period covered by the patent specifications, been totally neglected. The specifications tell only one tale, and that is how extensively the practice of charging and discharging retorts from one side of the bench has commended itself to gas engineers. Rotary projectors and ram discharging machines have their fresh arrivals; a proposal was made for charging retorts by steam-jets; and there is one machine which proposes to compete with the only existing representative of the principle of simultaneously discharging and charging of retorts.

This latter system of operation is, without doubt, going to take its share of future favour among gas engineers. It may therefore be of interest to call attention to the fact that a machine designed to discharge and carry forward a new charge in, practically speaking, one operation was designed by Mr. W. Grice, as far back as 1884, and was illustrated and described in the "Journal" for Aug. 25, 1885 (p. 343). This machine was tried in No. 3 retort-house at the Saltley works of the Birmingham Corporation; but it was not at the time successful. We have made inquiries of Mr. Henry Hack as to his recollections concerning this machine, as nothing appears to have been placed on record in respect of it after the publication of the patent specification and the exhibition of a model of the machine at the Manchester meeting of the Gas Institute in 1885. Mr. Hack has kindly given us some information, and has also interested himself in the matter by inquiring of Mr. Harry Grice, and Mr. J. W. Morrison, the Engineer of the Sheffield United Gaslight Company (who was at Saltley at the time), as to their recollections of the experiments with the machine. By the machine, it appears, the coke was drawn from the retort by the inward stroke of the pan, and the coal charge deposited in the retort by the outward stroke; so that, although both operations were performed by once inserting the pan in the retort, they were not performed simultaneously. Mr. Harry Grice (who carried out the trials at Saltley) says that the machine, with the exception of the shoot and chain, was constructed of cast iron; and he attributes its failure to the continual breakdowns due to the large use made of this material. Mr. Morrison says the machine was cleared out because it left the coal all of a heap in the retort, instead of evenly distributing it; and that the charging-pan, being all in one piece, practically the width of the retort—and non-flexible—jambed itself with any small pieces of coke that happened to be left in the retort. Mr. Hack's memory practically agrees with Mr. Morrison's statement, but he thinks that Messrs. Grice and Sons were not wise in making no attempt to improve the working of the machine, and were too

precipitate in scrapping it. They spent a lot of money upon the plant; and one can understand that they got disheartened, and so gave the job up as a bad one. On looking at his report-book Mr. Hack finds that the following appears under date of Dec. 18, 1890: "The charger has been at Saltley since May last. Work has been going on on it ever since; and as it was causing us considerable inconvenience, and I could see no prospect of it ever being of service to us, I requested Messrs. Grice to remove it, which they are now doing. Several attempts were made to draw and charge the retorts, with indications of success, but the principal cause of failure is that they made the sides of the tray and the blades of the chain rake too deep, causing it to jam in the retort, which could only be avoided by the attendant adjusting the tray to the retort to a degree of nicety that would be impracticable in ordinary working. Another difficulty was that they had only made the tray and chain rake long enough to draw and charge a retort 8 feet long (excluding the mouthpiece), instead of 10 feet, the length they knew all ours to be."

Inclined retorts have been sadly set aside by inventors. Only one specification throughout the year had reference to them, and that described a method of charging. Vertical retorts, on the other hand, have been in great evidence—the Woodall-Duckham being particularly prominent with the various patents the inventors have taken out to overcome the difficulties and meet the requirements found in their lengthened and careful investigation. The specification of the Young and Glover system was published in the course of the year; and a modification of the Dessau system was described. The continuous feeding of vertical retorts is a feature of most of the arrangements that were noticed; but one patent from abroad was more especially devoted to describing one means of accomplishing this. Another specification specifically announced that the intention of the patentee was to produce, by the vertical retort, coal and water gas, though this is not an unknown purpose of other systems that have already been mentioned. Besemfelder's arrangement, too, for continuous carbonization, and the production of mixed coal and water gas, also saw the light of day—in descriptive form. A specification from abroad referred specially to the construction of furnaces for vertical retorts.

Among miscellaneous subjects in connection with retort-house operations and equipment, attention was directed to a much criticized proposition for the blending of producer gas and coal gas, to the carbonization of raw combustible materials containing large quantities of water, to a belated attempt to produce economy in the enrichment of gas by the aid of husks or shells of cotton seed, to a plan of utilizing superheated steam for the destructive distillation of coal and other substances, to the utilization of coke breeze in retort furnaces, to a method of introducing steam into retorts, to the application to retorts of a water-spraying device for the removal of carbon, to a plan of measuring and delivering coal to retorts, and to a system of making briquettes from coal dust, lime, and pitch for carbonization, in order to produce lighting gas and a dense coke. Improvement in bench mountings appears to have almost reached a state of finality; for standpipes and connections were only referred to once, and retort-lids the same. Great Britain monopolized consideration for coal and coke elevators, with three descriptions of improvements in details, and one of a fresh idea for controlling and regulating the feed of coal to elevators and conveyors.

Other Gas-Manufacturing Systems.

We have in this review removed from the ordinary carbonizing section those systems of gas production that depart from gas-works ordinary practice, but some of which are, with time and changed view, becoming very closely identified with the condition of things that the course of events appears to be leading to. It cannot be denied that the vertical retort draws closer the relationship between gas-works practice and the methods of manufacturing producer gas. We have been describing vertical retorts, and here we have a connecting link in a British specification, which delineates a plan for simultaneously making coal gas and producer gas by the disposition of a vertical retort inside the producer of a gas-generator. That secures most intimate relationship. Then we pass on to find that the gas-producers to which it was thought fit to accord notice during the year were only three in number. Leaving them, it is interesting to remind readers of the presentation of a system for the manufacture of a non-toxic gas, free from the objection of naphthalene and similar deposits in the mains. In this case, the carbon monoxide is removed, and in its place is the valuable and non-toxic constituent methane. This looks very attractive; but more definite information is required as to its practicability. Consideration was also invited to a plan for the production of a permanent gas by the passing of finely divided hydrocarbons and superheated steam over a heated contact material containing protoperoxide of iron. Getting further away from the utilization of coal for the production of gas, a vertical kiln was described for the gasification of peat; and an inventor who does not believe in waste described how power gas may be recovered in the process of lime-burning. The birth-rate of suction gas-producers shows no diminution in this country; but, of course, many of them are designed with the view of overcoming difficulties that will keep cropping up in connection with these plants. A couple of pressure gas producers from abroad were described. Connected with these types of plant may be mentioned an arrangement for controlling gas-engines working with poor gas. Carburetted air gas lingers; but we only gave to the system one notice during the year. The name of the originator of the Dessau vertical retort, appears in conjunction with a water-gas system; and there are a couple of British representatives in this field. Altogether, in this section, 22 specifications were noticed; seven being introductions from other countries.

Hydraulic Main to Gasholder.

Returning to the ordinary processes of the gas-works, specifications relating to plant and methods between the hydraulic main and the holder were dealt with to the extent of 21—four being importations. Attention continues to be given to devices for the regulation of the seals of dip-pipes; and to their sealing and unsealing. An idea for simplifying the collection of pitch from hydraulic mains was explained; and a suggestion was made for the cooling of gas issuing from dip-pipes in the hydraulic main. The purification department is not denied attention; nor were the year's specifications in this line devoid of interest. There is room for the development of purification processes that require less cumbrous plant and methods than the present. The abolition of lime purification lessens the requirement for purifier-boxes; and the service of purifier-boxes is being economized by the new internal arrangements for the better depositing and utilizing of the purifying material in them. There were two or three specifications treating of such matters. Then there is another patentee who assumes that he is able to successfully dispense with the ordinary condensing plant, and to conduct the operations of removing tar and ammonia simultaneously. Three specifications were devoted to telling how washing gas by liquids, in accordance with the methods described, was highly successful in its cleansing effect. A system of treating spent oxide for revivification came under notice. Regarding other plant a multiple way or change valve, with liquid seal, was alluded to; improvements in a station meter and a rotary meter were brought forward; and one inventor, in three specifications, showed that he had been busy in producing dependable anti-pulsators for gas-pipes, so as to enable inferential station meters to be used for gas-engines. A regulator for gas-heated steam-boilers was among the miscellaneous contrivances of the year. In connection with gasholder work, a description of Mr. Gadd's improvements in columnless gasholder guiding was placed in the possession of readers; the only other mention of gasholders having reference to an anti-freezing device.

Distribution Department.

When we leave the gas-works, there is such a miscellaneous collection of devices in the distribution and lighting sections that they can only be dealt with most cursorily. Coming within the distribution section, are specifications numbering 39, and comprising all sorts of subjects ranging from lamplighters' torches to couplings for pipes; but only seven of the patents crossed the seas. It is again interesting to observe that the greatest activity prevailed in the meter department, and that history continues to repeat itself, in that the prepayment meter has not been courted much by inventors abroad—that is, if judgment can rest solely upon the small amount of protection sought for by them in this country. Eleven specifications dealing with prepayment meters were epitomized; and only one of them was not of native origin. Stop mechanism puts in a single appearance. While a lock and a special drawer are proposed for the prevention of depredations in connection with prepayment meters, another proposition is a system for using tokens instead of cash. A further invention proposes the combination of a change-giving apparatus with prepayment meters—an idea that, so far as this country is concerned, is not likely to receive any great encouragement. Occasional notices had to be given to ordinary meters—but only three all told. A differentiating meter engaged attention, and a meter that is invested with the duty of delivering its own bills was also described. Means for facilitating work on distribution mains have been devised—among them being a method of drilling and tapping gas-pipes under pressure, and another for ascertaining whether plugged pipes have been closed absolutely tight. The provision of leak-detecting chambers was the object of a further patent. Protection has been obtained by an inventor abroad for a mechanical arrangement for increasing pressure in gas distribution; and for the purpose of synchronizing clocks, a system of temporarily increasing gas pressure was described—this having reference to the development at Leamington. No less than three home proposals were introduced for measuring and recording the volume of gas and other liquids flowing through pipes.

Utilization.

The field for the utilization of gas is large; and the specifications of patents that we noticed were in consequence numerous—too numerous for anything like individual mention of the subjects. If we include incandescent matters, it is found that in this one section alone no less than 158 specifications were dealt with in the year, or more than half the total number—77 being natives, the remainder coming chiefly from the Continent, America also contributing. If, again, we exclude all the sundries and the lighting and extinguishing arrangements, it is seen that 87 of the specifications are identified with incandescent lighting in one way or other. We are afraid that incandescent lighting offers a "fatal facility" to people for enrolling themselves, or for fancying they are entitled to be enrolled, among inventors. The title of some of them it is difficult to appreciate; and the utility of certain productions we fail entirely to detect. Several ordinary burners, with variations—mostly small—in their construction, were noticed. Anti-vibrating arrangements still continue to find some favour with

designers. We are reminded once again of the application of a fan inside burners for increasing velocity and thoroughly mixing the gas and air supply. High-pressure and self-intensifying gas-lamps have been improved in certain instances by obtaining over them a better control and improving their fittings. Compressed-air supply for incandescent lighting has received more prominence; and means of compression for both gas and air have not been neglected. Coming to inverted burners, we have had in connection with them, if we except lighting and extinguishing devices of all kinds, the largest number of specifications to notice—their number being 28, of which 14 were originated in this country. Among the prominent features, the question of the regulation of supply has been studied, and the necessity of accessibility for cleaning has been recognized—a wonderful arrangement of lamp hinged in every part being one of the productions. We have had burners of a cross-breed, in which vertical burners are used with mantles formed and arranged (in one case the mantle is of saucer shape, with a central hole for the burner) to give the appearance and advantages of the inverted burner with the advantage (whatever it may be in such a case) of retaining the vertical form of burner. In one or two other instances conbination fittings with vertical and inverted burners have been designed. Quest for stronger mantles, it is seen, goes on with unabated vigour—some attacking the problem in connection with the fabrics, others relying on artificial silk and a second impregnation—in one case with hydrogen peroxide, as recently fully described in the "JOURNAL"—and again a framework of fine metallic wire is proposed. A curious idea was introduced in a mantle composed of a plurality of hollow sections forming a ring. The practicability of many of these ideas has to be demonstrated. If a small proportion of them will only do in ordinary use what their inventors claim for them all, we shall have made very substantial progress in incandescent gas lighting.

Grouping all the remainder of the arrangements in the department of utilization, it is remarkable, in the first place, how year after year lighting and extinguishing devices retain hold of inventors. If such things have been a felt want in the gas industry, there ought not now to be any difficulty in providing, from the huge pile of ideas in this category, several suitable arrangements. We have in the twelve months chronicled thirty or more forms of appliances and methods under this head—two-thirds of which have had origin outside this country. Safety taps and burners have been described. There has not been anything of striking importance among the specifications in connection with fires, stoves, or gas-engines, though several have received notice.

Residual Products.

Here there has been unwonted activity, in which this country has participated in no mean degree; but we are afraid, from what is gathered from the specifications, that the gas industry will not be substantially bettered by the inventions—excepting may be from those that enable spent liquor from sulphate plants to be disposed of without nuisance. The utilization of tar for paving has found its way to notice on two occasions; and some proposals refer to improving the recovery of ammonia, tar, ferrocyanides, sulphocyanides, pyridine, sulphur, and so forth. Sulphate of ammonia manufacture was dealt with in one or two instances.

Gas Testing and Analysis.

The published specifications in this the final section comprised the Carpenter and Grafton testing-burners, a couple of calorimeters, and an apparatus for estimating and recording the quality of gases by a comparison of the densities of different gases as exhibited by their relative rate of diffusion through a porous septum. Gas analysis and the measurement of high temperatures were not altogether lost sight of in the patent record.

We have received the first number of the "Natural Gas Journal," a new monthly publication devoted, as manifest by the title, to the interests of natural gas. Its principal feature is a report of the proceedings at the first annual meeting of the Natural Gas Association of America, held in Kansas City last June, with a portrait of the President (Mr. Kerr Murray Mitchell); and the other matter consists of news items from various localities. The Managing-Editor is Mr. J. Alex. Mayers, who appears to be well known on the other side of the Atlantic in connection with the supply of natural gas.

At a conference of motorists and others interested in the condition of the country roads, held at the suggestion of Lord Montagu at the Automobile Club last Thursday, it was decided to form a National Dustless Roads Committee. The purpose of the Committee is to amalgamate all the individual and combined efforts that are being made in this direction, and to take advantage of the experience of individuals and public bodies who have been making experiments in the treatment of roads with the object of preventing the nuisance of dust that exists at the present time. A meeting of the Council of the Roads Improvement Association will be held to-day, to give effect to this resolution; and they will also settle the rules for a competition to determine the best form of tar or preparation of tar to be used for road purposes. This competition is supplementary to the one for the best tar-spreading machine referred to in the "JOURNAL" last week (p. 144), the rules for which have already been issued.

THE CEROFIRM MANTLE.

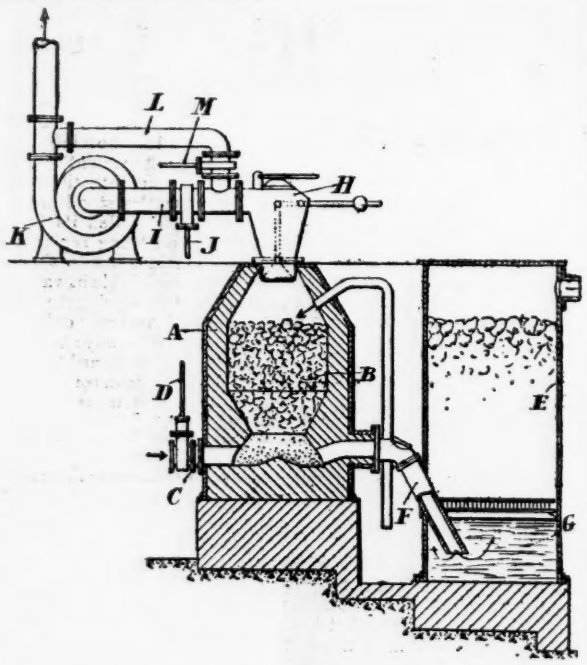
THE "Cerofirm" gas-mantle was yesterday introduced to a number of gentlemen in the City, at a little meeting specially arranged to demonstrate its merits. This is the mantle which formed the subject of a highly interesting article by Dr. C. R. Böhm in our columns on the 25th ult.; and those who saw the demonstrations with the mantle yesterday, and those who read this brief reference to what was seen, will desire to most carefully study that article for the purpose of ascertaining just wherein the mantle varies from the ordinary forms of manufacture. As was pointed out in the article, the base of the mantle is artificial silk, the fabric is impregnated in the ordinary manner, and then the thorium salts are heated with hydrogen peroxide; and, by this treatment, a thorium hydrate is obtained which does not expand but coheres. Now what is claimed is that the discovery of this particular treatment gives an exceptionally strong and flexible mantle and a mantle whose illuminating properties are well preserved. So far as it was possible to do so in a short time (except, of course, with regard to the illuminating power), Herr Bruno and his colleagues who are interested in the mantle demonstrated the veracity of their contentions. Several samples of the mantle were burned off in the presence of the visitors, then placed on a shock machine, and subjected to an arm-tiring number of violent vertical shocks—without damage. Mantles were twisted round the finger—without damage. Mantles were hooked on to the free end of a pliable wire held fixed at the other end, and the skirt of the mantle was pulled until the wire was bent—again without doing any damage to the mantle. There could be but one opinion that the mantle justified the claim to excellent merit in this regard; for practically all the violent treatment that a mantle could be subjected to without intentionally wishing to terminate its useful career, these mantles stood most boldly. The mantle, after being folded, too, revealed its fine elasticity by regaining its shape immediately on being replaced on a burner. Examples were also immersed in water to show that the valuable constituents of the mantle are insoluble in water, whereas it was possible by the same treatment to precipitate the salts of an ordinary mantle. The object of this test was only to demonstrate that the Cerofirm mantle was not in any way affected by moisture, nor by storage in damp places. With regard to the illuminating power of the mantles, there were no means of photometrically testing this; and as this is a mantle whose light, according to the inventor, is not at its best until (say) the lapse of several hours' use, it was not seen to the greatest advantage. But after a few minutes' burning, there was a distinct improvement to the eye in the illuminating power. Dr. Böhm, in his article, mentioned an average lighting power of 120 to 130 Hefner candles, with ordinary gas pressure and consumption; and certainly so far as yesterday's experience enabled judgment to be made, the mantle will give a good account of itself in this respect. But the striking feature was its structural tenacity, notwithstanding the beauty and fineness of its mesh. The mantle we learn has been largely adopted in Germany; and it is expected that it will not be long before we shall hear more about it in this country.

A "Water Arbitration" Prize Paper.

The Council of the Institution of Mechanical Engineers have announced that the Institution have received from the Metropolitan Water Board and Sir Edward Fry, the Chairman of the Court of Arbitration under the Metropolis Water Act, 1902, two sums of £250 each, which the donors desire to be used for some engineering purpose connected with the Institution. The Council have invested the amount—£500—in a trustee security, the income from which they have decided, after consultation with Sir Edward Fry, shall be offered biennially for a paper submitted in accordance with prescribed conditions. It has been further decided that the prize shall be known as the "Water Arbitration Prize," and shall be offered for a paper on an engineering subject, to be announced by the Council one year before the time for sending in the papers. The prize, which will have a value of approximately £30, will take any form which the Council may decide upon, and will be accompanied by a certificate bearing the seal of the Institution. The following are the conditions for the first award, to be made in 1908: (1) The award will be made to the author of the selected paper dealing with the filtration and purification of water for public supply. (2) Members, associate members, associates, and graduates of the Institution may compete. (3) Papers must be sent to the Secretary of the Institution, and reach him not later than Oct. 31, 1907. (4) Each paper must be clearly written, or typewritten, on one side only of foolscap paper, with a margin, and must be accompanied by an outline or synopsis of its contents of not more than 600 words. Any illustrations sent with the paper must be properly drawn to scale. (5) Papers submitted for competition will become the property of the Institution, and, at the discretion of the Council, may be either read and discussed at a general meeting or simply printed in the "Proceedings." Each paper must consist of original matter, written by the competitor himself; and the Council will require a written statement to this effect. Any paper not accepted for printing will be returned to the author. No paper which has been previously published will be accepted for competition.

A FRENCH WATER-GAS PRODUCER.

A patent has recently been taken out in France, by the Société pour l'Exploitation des Procédés de Production de Gaz Industriels, for a water-gas producer, the chief advantages of which are claimed to be the absence of all danger of explosion when it is at work, the greater facility with which it can be manipulated, and its inexpensiveness to construct. The producer is on the suction principle, and it is arranged as follows: A charging-vessel, shaped like a coal-hopper, placed directly above the generator, is connected by a gas-pipe with the fan or blower; and the hot gases are conveyed to the chimney by means of an auxiliary pipe without passing the fan—the latter pipe being utilized for starting the plant, as well as during cessation of work when the generator has to be kept hot. The fire-bars hitherto employed in producers of this type are done away with in the one under notice; and the charge of fuel rests either upon the bottom of the generator or upon the bed of clinker and ash formed in the course of work. The steam-pipe terminates in the upper part of the generator, and the gas-pipe, at the base, in the washer. Between the two vessels there is simply a hydraulic seal, so arranged as to allow the gas to pass easily into the washer.



The construction of the producer will be understood from the accompanying illustration. A is the generator, with its charge of coke B. Air is sent in through the pipe C, which is furnished with a damper D; and the gas passes into the washer E by the pipe F, the end of which, as will be seen, is below the water level G. H is the hopper, which is filled at the top, and emptied at the bottom by means of the lever shown. A pipe I, furnished with a damper J and a fan K, is connected with the hopper, as is another L, provided with a damper M, which has a large opening equal to the diameter of the pipe and another much smaller. This damper can be quite closed.

The action of the apparatus is as follows: When starting, the damper J is shut and M is opened to its fullest extent, so that the gases may escape by the pipe L. The bottom of the hopper is lowered by means of the lever, and the damper on the pipe C opened as required. At the time of heating up, this damper, as well as J, is fully opened, the damper M closed, and the fan K on the pipe I started. The damper J is open and M is shut during working. When the necessary heat has been attained, the fan is stopped, and the production of gas begins. The damper D and the bottom of the hopper are closed, steam is admitted by the small pipe, and the gas generated escapes into the washer through the pipe F. During the production of gas, opportunity may be taken to re-charge the hopper, so as to save time. When scurfing is being done, the damper I is kept closed and M is brought into such a position that the escaping gases can only pass out through its smallest opening. This damper is also brought into the same position when the producer is stopped at night and the heat has to be kept up.

Leaving out of consideration the advantages resulting from the abolition of the grate, the facilities afforded for scurfing, and the production of a good quality of water gas, which contains very little carbonic acid, and always leaves the apparatus at the hottest part, a point worthy of attention is that loss of steam due to defective joints is impossible, as there are no joints. Moreover, all danger of asphyxiation from the chimney gases is avoided, as when the bottom of the hopper does not happen to be quite closed, only steam can escape, as it is this, and not water gas, that fills the upper part of the generator during its operation. Nor does any escape of gas take place during the process of heating up, as there can be only one suction of air. Consequently, the shutting-off portions of the apparatus have not to be adjusted so carefully as in other gas-producers.

A NOVEL INVERTED BURNER.

The current number of the "Journal de l'Eclairage au Gaz" contains a description of a new type of inverted incandescent gas-burner which has lately been brought out by the Société Française de Chaleur et Lumière, who are the French makers of the Kern burner. It is shown in the accompanying illustrations.

Fig. 1.

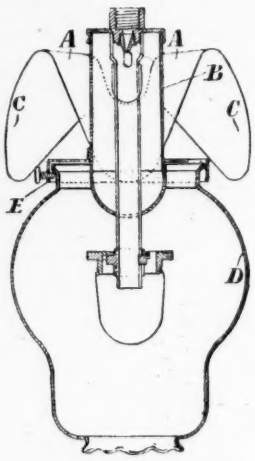


Fig. 2.

It will be seen from fig. 1, which is a general view of the lamp, that it is surmounted by a hood or cover of peculiar form, by the use of which, the makers claim, the current of air is directed upwards on its way to the burner, while the products of combustion are made to take a horizontal course, with the result that the pure air necessary for the supply of the burner does not mingle with them. Referring to fig. 2, which is a vertical section of the lamp, A is the hood or cover (its special feature), by the inclined sides of which the air is directed up to the openings into the burner-tube B; the other sides or wings C leading away the hot gases rising from the globe D by means of openings in the burner crown E. By this arrangement, the products of combustion are separated from the air going to the burner, and consequently the conditions for ensuring perfect combustion are realized. The bunsen burner consists of a tube of some metal which is a bad conductor of heat, such as iron, nickel, &c., surrounded by a jacket which prevents the products of combustion coming in contact with the burner, and overheating it. The intermediate space may be filled with some insulating material. The application of a casing, as described effectually prevents the return of the combustion gases to the burner, and thus removes a frequent cause of poor light.

Oil Shales of the Lothians.—The Geological Survey has prepared a valuable memoir on the oil shales of the Lothians. It is divided into three parts, the third of which, by Mr. D. R. Stewart, Chemist to the Broxburn Oil Company, deals with the chemistry of the oil shales and the processes and products of manufacture. The whole report, which has been edited by Dr. Horne, forms, it is believed, the most complete monograph that has been written on the subject. The importance of the industry in Scotland is shown by the fact that in 1904 a total of 2,332,000 tons of oil shale was mined, yielding 62,932,000 gallons of crude oil, from which was produced 2,517,000 gallons of naphtha, 17,000,000 gallons of illuminating oil, 38,000 tons of gas oil, 39,500 tons of lubricating oil, 22,500 tons of wax, 49,600 tons of sulphate of ammonia.

Local Government Annual.—We have received from the office of the "Local Government Journal" the sixteenth issue of the above-named annual, which has just been published. The main portion of the book is, as usual, devoted to the directory, which gives the names and addresses of the chief officials of all Corporations, London Borough Councils, County Councils, and other bodies throughout the kingdom. A feature which will be found useful is the insertion of the names of the Chairmen of Committees in the Metropolitan Boroughs; also the Chairmen of the London County Council Committees. The names and addresses of the Metropolitan Water Board are also included, and accompanied by a complete scale of charges for water in every district supplied by the Board. The charges for gas are also given. In addition to the directory, the book contains a good deal of information which will be valuable to persons connected with local government. It is edited by Mr. S. Edgecumbe Rogers.

OBITUARY.

The death took place at Arundel last Wednesday of Mr. CHARLES MARSHALL, a well-known resident of the town. He had filled the position of Engineer at the Duke of Norfolk's water-works since their opening about twelve years ago.

We regret to learn, from MM. Desclée Frères et Cie., the owners of the gas-works at Roubaix, of the death of M. AIMÉ WAUTELET, their Manager. Deceased was a civil engineer, and a member of the Société Technique du Gaz en France, having been elected in the year 1899.

The current number of the "American Gaslight Journal" contains an account of the life-work of Mr. ADAM WEBER, whose recent death, at his home in New York, at the advanced age of 82, was announced in the preceding issue. Deceased was born in 1825 at Bechtheim, in the Grand Duchy of Hesse Darmstadt, and was articled to his father, an architect and builder. When quite a young man he left his home for New York, and after carrying on a successful business as a builder, he, in 1855, established the first large fire-brick factory erected in the United States—the style of the firm being Messrs. Kreischer and Weber. The partnership, however, was very soon dissolved, and the succeeding firm, Messrs. Maurer and Weber, constructed in New York City the then largest fire-brick factory in the country. As the result of his intimate knowledge of fire-clays, Mr. Weber conceived the idea of putting upon the market clay retorts to supersede the iron ones then generally in use in gas-works. Success attended his efforts, and he soon had a large business. He patented several arrangements of retort-benches; among them being his half and full depth regenerative furnaces. He personally superintended the equipment of the retort-houses of the principal New York Gas Companies; and his name was known not only in almost every city in the United States, but in South America, Cuba, China, and Japan. He also devised an improved lime process for the removal of carbonic acid from gas. His friends in the gas engineering profession included all who were actively engaged in it between 1850 and 1900. In the last-named year, he relinquished the business in favour of his two sons, Mr. Oscar B. Weber and Mr. Albert J. Weber, the former of whom died suddenly rather more than two years ago. Deceased was a prominent member of the American Gaslight Association as well as of the Pacific Coast Gas Association; he was on the rolls of the American Engineers' and other clubs; and was connected with numerous enterprises—being one of the largest shareholders in the Consolidated Gas Company—as well as with civic and charitable societies. He was likewise a prominent Freemason. The funeral, which took place at Greenwood Cemetery, was attended by many representatives of the gas industry; among them being Mr. W. H. Bradley, the Chief Engineer of the Consolidated Gas Company, who had been intimately acquainted with Mr. Weber for forty years. Deceased is survived by his widow, two sons, and two daughters.

WATER BILLS FOR 1907.

SECOND ARTICLE.

IN the last number of the "JOURNAL," we noticed the Bills to be introduced next session by Water Companies. We now deal with those promoted by Local Authorities which contain provisions in regard to water supply.

The Ashton-under-Lyne, Stalybridge, and Dukinfield District Water-Works Joint Committee wish for an extension of the period limited by the Act of 1870, under which the Committee was constituted, as amended by subsequent Acts, for the completion of such of the works thereby authorized as have not been carried out, to ten years from the passing of the Bill, so far as the Chew reservoir is concerned, and in respect of the other works to the time when they will be required. Authority is sought to acquire additional lands within three years from the date of the Royal Assent being given to the Bill. The Committee desire to have their powers strengthened in regard to the protection of water from pollution. It is proposed to increase the contributions of the authorities constituting the Committee towards the expenses of the joint undertaking. [*Parliamentary Agents: Messrs. Sharpe, Parker, and Co.*]

The Birkenhead Water Bill is to empower the Corporation to obtain a supply of water from the Rivers Alwen and Brenig, in the county of Denbigh. The scheme is a very extensive one, as will be seen from the following outline of the works. It is proposed to construct three impounding reservoirs, one of them to be used for compensation purposes, two aqueducts or pipe-lines connecting the former reservoirs, and several road diversions, in the above-named county; a reservoir or tanks, two aqueducts, and a tunnel or culvert, in the counties of Denbigh and Merioneth; an aqueduct in the first-named county and in Flint; a reservoir or tanks in the latter county; an aqueduct, consisting of one or more lines of pipes, commencing at this reservoir and terminating at one to be constructed in the parish of Thingwall, in Cheshire; and an aqueduct running thence to the existing service reservoir of the Corporation at Flaybrick Hill, in the county borough of Birkenhead. Ten years are asked for the completion of the Alwen reservoir and the first line of pipes, with the accessory tanks and tunnel for the conveyance of water to the borough. Authority is sought to appropriate the waters of the two rivers named and their tributaries, as well as all streams or springs that may be intercepted by the works; but before using any of the waters taken, the Corporation are to provide compensation to the extent specified in the Bill, and also suitable drinking places for cattle. The Corporation ask to be empowered to supply water to local authorities, companies, or persons, and also to borrow such sums as they may require, not exceeding £1,750,000, for carrying out the scheme. But they do not propose to raise more than £800,000 until the first reservoir and pipe-line, with the accessory works, have been completed, and the contract for the construction of the second reservoir (to be situated upon the River Brenig) has been let. The money is to be raised by the issue of Corporation stock or by mortgage. Authority is asked to alter, as from the 29th of September next, the maximum charge for water used for domestic purposes, from £6 10s. to £12 10s.; and also to repeal certain enactments regulating the supply of water to the London and North-Western and Great Western Railway Companies. Provision is made for granting a rebate to owners and occupiers of all rateable hereditaments in the Oxton and Bebington wards of the borough if and so long as the charges for water supplied for domestic purposes by the Wirral Water Company are higher than those of the Corporation. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

The Birmingham Corporation Water Bill is to amend certain provisions of their Water Acts in regard to the repayment of moneys borrowed for the purposes of those Acts. The Bill is short, consisting of only the preamble and three clauses, of which the second is the most important. It sets forth that in the case of all stock created and issued or transferred, and all moneys borrowed on mortgage or bills, for the purposes of the Corporation's Acts of 1892, 1896, and 1902, and outstanding on March 31 last, it shall not be obligatory upon the Corporation to commence payments into the loans fund of annual sums for the redemption of such stock, or to create any sinking fund, until the expiration of sixteen years from the date of issue or transfer of the stock or of the borrowing on mortgage or bills. The enactment is not to impair or affect the obligation of the Corporation to make provision for the redemption of stock and to repay moneys borrowed on mortgage or bills within the period of sixty years mentioned in sections 68 and 69 of the Act of 1892. [*Parliamentary Agents: Messrs. Sharpe, Parker, and Co.*]

The Broadstairs and St. Peter's Union District Water Bill is to authorize the Urban District Council of Broadstairs and St. Peter's to construct additional water-works, and to confer upon them further powers in relation to their water undertaking. The works comprise a well and pumping-station in the parish of Eastry; an underground heading, consisting of a line or lines of adits and all necessary works connected therewith, in the same parish; and a line of pipes commencing at the well already mentioned, and terminating in a tower and tank to be situated in the parish of St. Peter Extra. Five years are asked in which to complete the works. The District Council require authority to make bye-laws for preventing the pollution of the water, and to repeal the section of their Act of 1901 limiting the rates and charges at which water is to be supplied for domestic purposes, so as to make the maximum charge £8 15s. per cent. per annum upon the gross estimated rental of the premises, according to the valuation list in force at the commencement of the quarter for which the rate accrues, or to the last poor-rate in the absence of a list. Power is sought to sell or let meters; and the Council wish to be relieved of the compulsion to afford a supply of water for domestic purposes for less than twelve months. Authority is required to borrow the sum of £54,000 for the purchase of land and the execution of the works specified; £5000 for new mains, extensions of service-pipes, and meters; the sum requisite to defray the expenses of obtaining the Act; and, with the approval of the Local Government Board, such further amount as may be needed in connection with the water undertaking. The first-named amount is to be repaid in sixty years, the second in thirty years, from the time of borrowing. The costs of the Act are to be liquidated within five years from the date of the Royal Assent; and the money sanctioned by the Local Government Board, within such period as the Board may approve. [*Parliamentary Agents: Messrs. Lees and Butterworth.*]

The Coventry Corporation Water Bill is mainly to authorize the supply of water to the city by the Corporation of Birmingham. Power is sought to lay down a line of pipes commencing at the Whitacre pumping-station of the latter Corporation at Shustoke, passing through various parishes, and terminating in a service-tank to be constructed in Coventry, at a point adjoining the southern of the two existing service reservoirs at Coundon. Five years are required for the completion of these works. The Birmingham Corporation will undertake to furnish a supply of water for a period of sixty years, on terms and conditions fully set forth in the Bill. The quantity of water is not to exceed 100,000 gallons per hour, and the charge is to be 4d. per 1000 gallons, subject to a minimum rate of £1250 per quarter for a minimum of 75 million gallons delivered in that period; the supply of water to be given and taken within three months from the completion of the aqueduct, meter, and subsidiary works. The water is to be that which the Birmingham Corporation draw from the Bourne; but provision is made for a supply from their Welsh works. The charges for water for domestic purposes are based upon the rateable value of the premises supplied; but the Corporation may

sell by measure at a maximum price of 1s. 6d. per 1000 gallons. Authority is sought to borrow £81,000 for the purchase of lands and the carrying out of the works specified; also whatever sum may be necessary to defray the cost of obtaining the Act, and such further amount as the Local Government Board may sanction. A period of sixty years is required for the repayment of the first-named amount; five years for the second; and such time as the Board specify for the third. [*Parliamentary Agents: Messrs. Sharpe, Parker, and Co.*]

The Devonport Corporation Bill is, among other things, to confer further powers upon the Corporation in respect of their water undertaking. They wish for authority to lay down a line of pipes commencing at Walkhampton, at a service-tank to be constructed there, and terminating near the existing reservoir at Tamerton Foliott; another line commencing at Egg Buckland, and also terminating at Tamerton Foliott in a reservoir to be built; and a filter-bed in the same parish, adjoining the Crownhill filter-beds of the Corporation. Seven years are required for the completion of these works. It is proposed to alter section 19 of the Corporation's Act of 1902, relating to water-rates for domestic purposes, and base the charges upon the gross estimated rental of the premises supplied, as set out in the Bill; also to vary section 70, so as to make the dates of payment the first day of each quarter of the year instead of the usual quarter days. The Corporation seek to be empowered to make bye-laws for providing for the testing and stamping of water-fittings, and to enter into contracts for the supply of water in bulk beyond their limits, on terms and conditions to be agreed upon. Authority is required to borrow for the purchase of land and easements and the construction of water-works, £61,000; for blocking portions of the existing leat, £11,000; and for general water-works purposes, including the provision of new trunk and other mains, £8000—all to be repaid within sixty years from the date or dates of borrowing. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

The Heywood and Middleton Water Board Bill is to extend the time limited by the Heywood and Middleton Water Board Act, 1901, for the construction of certain works, and to confer further powers upon the Board with respect to their water undertaking. The works referred to were originally sanctioned in 1877; and the time specified for their completion has already been three times extended. A further period of ten years is now applied for, as well as additional powers in regard to the purchase of land. The Board wish to be authorized to borrow £120,000 for this purpose, and for meeting the excess expenditure required for the completion of the Ashworth Moor enlarged reservoir and other works authorized by the Acts of 1877 and 1901, including the payment of interest out of capital during construction; £5000 for making filter-beds; the sum necessary for defraying the costs and expenses of the Act; and, with the consent of the Local Government Board, such further amounts as may be needed. Sixty years are asked for the repayment of the two amounts above specified; but a period of seven years is required after borrowing, or eight years after the passing of the Act, before commencing the formation of a sinking fund. Provision is made for the transfer to the Board of the sum of £152,612 stock borrowed for the purposes of the water undertaking of the Heywood Corporation before its transfer to the Board, which, on March 31, 1907, is properly charged on the revenue of the undertaking; but from that date all the Heywood Corporation redeemable stock, except the above-named sum, is to cease as a charge on such revenue. [*Parliamentary Agents: Messrs. Sharpe, Parker, and Co.*]

The Keswick Urban District Council (Water) Bill describes and sanctions the existing water undertaking of the Council, authorizes the construction of works, and defines the limits of supply. The new works for which authority is sought comprise a line of pipes commencing at a point in a pipe coming from the intake on the Whit Beck, and terminating in the existing Millbeck reservoir, and a reservoir adjoining the one just named. The limits within which the Council wish to supply water are fully defined in the Bill, but cannot be indicated without the aid of an Ordnance map. The charge for water for domestic purposes is to be on the rateable value of the premises; and where the supply is by measure, the price is not to exceed 1s. 6d. per 1000 gallons—supplies in bulk to be furnished on terms and conditions to be agreed upon. The Council wish to be empowered to borrow any sum not exceeding £8400, to be repaid within sixty years. Separate accounts will be kept in respect of the moneys raised for the water-works undertaking, and the charges on the revenue thereof. [*Parliamentary Agents: Messrs. Dyson and Co.*]

The Leeds Corporation Bill is to sanction (*inter alia*) the construction of certain water-works. Before these are specified, however, those which it is proposed to abandon are defined. They include the Colsterdale reservoir, a portion of an aqueduct, a pipe-line, and two road diversions sanctioned by the Corporation's Water Act of 1901; and any damage done in respect of them is to be compensated for. The new works consist of a reservoir in the parishes of Healey-with-Sutton and Colsterdale, to be called the "New Colsterdale Reservoir;" an aqueduct commencing in the one of which a portion is to be abandoned, and terminating in the new reservoir just referred to; a covered service reservoir in the township of Armley and Bramley, and another in the township of Holbeck; and various conduits or pipe-lines and a road diversion. A period of nine years is required within which to complete these works; and the time-limit for carrying out those authorized by the Act of 1901 is to be extended till the expiration of five years from Aug. 17, 1911. This Act is also to be amended in regard to the supply of compensation water. The Corporation wish for authority to apply, for or in connection with the purchase of land and the execution of the works above specified, any moneys borrowed or to be borrowed under the Act already mentioned. [*Parliamentary Agents: Messrs. Sharpe, Parker, and Co.*]

YORKSHIRE JUNIOR GAS ASSOCIATION.

When Mr. Thomas Newbigging addressed the members of the Yorkshire Junior Gas Association at their annual meeting last October, among other pieces of advice, he urged them to acquire a familiarity with ordnance maps, and a facility in gaining from them all the information they contain—saying that though it might seem an out-of-the-way thing to recommend, he had constantly found that he had to have recourse to them in his professional career, and he had been surprised to find how ignorant of them many men were whose daily work would be materially assisted by a frequent and intelligent use of ordnance maps.

This advice was taken to heart; and in a few weeks the Secretary was able to inform Mr. Newbigging that arrangements had been made for an address on the subject to be delivered to the members. This was given on Saturday last, in the Lecture Theatre of the Halifax Technical School, by Mr. J. H. R. Appleyard, B.Sc., formerly Demonstrator in Geology at the Yorkshire College (now the Leeds University), who announced his subject as "Ordnance Maps: What They Teach Us, and How to Read Them." The lecturer had a large assortment of ordnance maps of all the scales on view, including specimens of the various geological survey maps, and of the various kinds of physical maps, large and small—especially those coloured to show the various levels. The lecture was really an informal lesson, illustrated on the black-board, &c., and followed by the members from the actual maps, as the lecturer was able to distribute among his audience a considerable number of copies of the four quarter-sheets (on the one inch to the mile scale) that cover the Halifax district. Members were invited to ask questions as the lecture proceeded; and full advantage was taken of this permission. Great interest was awakened in what was a notable feature of the lecture—viz., a set of eight relief models made the full size of the quarter-sheet maps. These had been built up by the lecturer and some of his pupils from the contour lines of the actual ordnance maps. The six quarter-sheets actually used in their preparation were affixed to the black-board, and the models were placed just below for comparison.

The sheets had had all the contour lines thickened out in alternate black and red lines—no light task, as can be proved by anyone who sets himself to do it. At least, it is no easy task on such maps as those of the Halifax district, which is intersected by deep, steep-sided valleys, and well populated. This means, of course, that the contour lines in parts are very close together, and, being much broken by names, are not easily followed, but may be confused with others. Sheets of cardboard whose edges were the exact shape and size of the various contour lines were then fastened on one another, and the whole mounted and painted. The elevations were somewhat exaggerated; the vertical scale being about two or three times the horizontal. Upon the meaning of contour lines, and the need of being by their aid readily able mentally to see the ordnance maps as physical maps, the lecturer laid great stress; showing the inter-connection of the ordnance map, the physical map tinted to indicate elevations, and these relief models. The most notable model of all was one specially prepared for the occasion—plainly at no small cost of time and trouble; and for this the liveliest admiration was expressed. It consisted of a relief model made as in the former instances, except that every exposed surface was a portion of the actual map; so that, looking down upon it, one saw the complete actual ordnance map of Halifax in high relief. No such map models as this are on the market; and as far as the lecturer had been able to ascertain, only one has hitherto been made in the geological or geographical departments in any of the Universities.

The meeting, at which the President (Mr. G. W. Fligg) occupied the chair, passed an enthusiastic vote of thanks to the lecturer, which was spoken to by several members. The Halifax Corporation Gas Engineer, Mr. J. Wilkinson, who has been suffering from an attack of influenza, sent a message of regret at being unable to be present at the first meeting held for some time at Halifax. Mr. John H. Brearley, the President of the Manchester District Institution of Gas Engineers, who was present, joined in the general appreciation, and congratulated the members on their enterprise in securing so able a lecture, and on their alertness in taking up a subject somewhat new to gas meetings. He remarked on the frequency of the loss and inconvenience arising to gas undertakings from not having a complete, accurate, and sufficiently minute map of the works' connections and mains and services, and suggested that some member might prepare a paper on the subject, showing how best to go about preparing such a map, and thus lay a good many seniors, as well as juniors, under obligation to him.

Masonic.—Bro. F. F. Farrand, the Engineer and Manager of the Ryde (Isle of Wight) Gas Company, was last Wednesday installed W.M. of the East Medina Lodge, No. 175, in succession to Bro. A. E. Coombes, the Secretary of the Company.

LIGHTING OF RAILWAY PREMISES.

Resumed Discussion on Mr. Fowler's Paper.

At the Meeting of the Institution of Mechanical Engineers on Friday, the discussion was resumed of the paper on the above subject, which was read at the December meeting by Mr. HENRY FOWLER, of the Lighting Department of the Midland Railway Company, Derby. An abstract of the paper, together with a report of the opening of the discussion, will be found in the "JOURNAL" for Dec. 18, p. 818. The chair last Friday was occupied by Mr. E. P. Martin, President of the Institution.

Mr. GEORGE HUGHES remarked that the lighting of a railway was not only of vast scientific, but also of enormous commercial interest. They would readily realize that the annual expenditure must be a very considerable sum. The lighting of a railway, in its comprehensive nature, embodied not only what the author had so ably dealt with, but also such items as train lighting, and the lighting of signals, hand-lamps, and of the head-lamps of trains. The paper itself to him was a valuable one; and he had no doubt it would form a very useful record for reference. The author told them that the selection of a lighting agent was necessarily of a restrictive nature, in the sense that every station or other point that had to be lighted, had to be considered independently. That was to say, every selection had to be made on its merits, as it were; and before this could be done, the selector must know absolutely the conditions. Mr. Fowler told them that they had in particular three agents—oil, gas, and electricity, without considering for the moment their subdivisions. He thought they all would admit that electricity had given a tremendous fillip to the gas industry; and he believed now gas lighting had become such a formidable competitor with electricity, that it in its turn would give a tremendous fillip to electric lighting. Suppose they selected a small country station. Their experience on the Lancashire and Yorkshire Railway was generally in employing oil-lamps giving about 11-candle power, and burning on an average five hours a day. The cost of these amounted to about ¼d. a light per diem. Now in a country station the only other available agent would probably be acetylene; and from their experience, this would cost, under the same conditions, about twice as much. Therefore for a small country station, oil came in first. Where gas and electricity could both be obtained, their experience was that incandescent gaslight, with an ordinary "C" burner, was the cheapest. The cost of this amounted in their case to just under 1d. per light for an average of five hours, for 60-candle power; and where they employed compressed gas—when he said compressed gas, he meant high-pressure gas at about 8 inches—it was much cheaper. He did not wish to go through the paper in detail, though there was a lot that might be said. He would pass over a great deal in order to come to a point in reference to train lighting on which he set much value. Mr. Fowler had not dealt with train lighting; but he had alluded to the effect of it on platforms. For a great number of years, gas had been a most valuable agent for train lighting; but at the present time, as they all knew, it was under a cloud, because certain gentlemen of great authority had pointed out that in train wrecks it added something to the risks. He had examined the records of all the accidents to passenger trains reported upon by the Board of Trade within the last 26 years; and the result was that out of 1478 accidents, there had been 14 cases in which the wreckage had been involved in fire.

The PRESIDENT pointed out that the question of train lighting had been purposely avoided by the author; and it was a little outside the discussion at present. They would, however, be pleased to hear what Mr. Hughes had to say.

Mr. HUGHES (continuing) said an examination of these 14 cases amounted to this—that in one instance the fire was due to a defective motor, in one it was owing to a lighted reading-lamp, in three cases the cause could not possibly be ascertained, in four instances it was due to gas, and in five it was originated by the fuel under the locomotive. So that the fires caused by gas amounted only to 0·27 per cent. of the total number of accidents. He was not taking sides one way or the other; but the facts he had mentioned should re-assure the British travelling public. The position of such a valuable lighting agent as gas should not be prejudiced. What they should go for was the prevention of accident; and if they succeeded in this, the secondary cause of risk would take care of itself. [Mr. Hughes then showed on the screen some photos of the lighting of the railway shops at Horwich, with arc lamps, as well as the interior of a saloon lit by incandescent gas. He also exhibited a diagram with reference to "Tantalum" and ordinary carbon filament lamps. This showed that the "Tantalum" lamp was much more economical, though the first cost was greater. The "Tantalum" lamps ran about 1200 hours, and only lost 3 or 4 candle power; whereas the filament lamps fell from 30 candles to 10.]

Mr. MACKWORTH PRAED remarked that the subject under discussion was most interesting, and one upon which Mr. Fowler must have bestowed an infinity of trouble and time. There were, however, one or two paragraphs in the paper in which air gas was dealt with to which he (the speaker) took exception, as well as one with which he most heartily concurred. To take the latter first, the author said he believed that there was a future before petrol-fed lamps. This he (the speaker) entirely agreed with; but, most unfortunately, the author added that the time for their general adoption had not yet come. He wished to call the attention of the members to a plant for utilizing petrol [which was shown in operation at the meeting], which was the invention of Mr. John Gore, of Sutton; and he said that there were no doubt others of a similar kind. This particular machine, he said, Mr. Fowler evidently had not had an opportunity of testing. It was stated in the paper that the air was usually carburetted by passing it over or through the petrol; but in the machine before them neither the one thing nor the other was done. In the course of a description of the apparatus which Mr. Praed read to the members, it was pointed out that the petrol was atomized and sprayed on to the air, by which it was absorbed; and the mixture passed off as a fixed gas. Any small amount of petrol that might not be absorbed by the air, returned to the tank. New pipes should be put in for this system; and under no circumstances should pipes be employed that had been used for acetylene, as there was something about them that seemed to have a detrimental effect on air gas. The only difficulty which presented itself was the supply of petrol, which should always be of a specific gravity not greater than ·65 to ·85. Generally, however, one could get petrol of the desired quality. He referred to an installation fitted up at Pirbright Camp, and stated that for 56 lights and 5 bunsen burners for a hot-plate, the cost was £1 15s. per month, as against £4 estimated for oil to give an equal light and cooking facilities.

Mr. HENRY LEA said in the early part of the paper there was a reference to a photometer for ascertaining what really was the amount of illumination obtained from the lights which were installed. Of course, he supposed most of them would think this was a reasonable way of testing what one was doing; but some years ago, when he wanted to go into this matter rather carefully, he found that no such thing as a photometer for the purpose was obtainable, because the demand for it, he was told, was so small that it was not worth while keeping it in stock. One was, however, made for him, but failed to work properly; and as it seemed so difficult to get what he wanted, he himself devised a photometer, which he found satisfactory, and which he had not patented. He would point out that the illumination of a room should not be measured on the floor. What people wanted to know was how many candle power of light there was at somewhere about desk or table level. Therefore he made his photometer about 3 feet high, so as to correspond to an ordinary table. It was a plain square box, with a top having a round hole through it, and a grease spot. A slider carried an electric lamp, properly calibrated to give a light of 1-candle power at a convenient voltage, which was easily ascertained by a volt-meter fastened on the photometer—the electricity being derived from two or three small storage cells. The slider and the lamp were attached to a cord running over a pulley; and by means of this cord, the lamp could be raised or lowered. A little projection on the back of the slider was opposite the centre-line of the filament lamp, and slid up and down a slot in the box. This opening, while the observation was being made, was closed by a shutter. It was very easy to stand about a yard off with the cord in one's hand, and pull it to and fro, until one got a balance of light on the grease spot. Then the cord was fixed, and the shutter opened; and one could look at the scale arranged at the side of the slot. This scale was calculated on the basis of the light varying inversely as the square of the distance, and enabled one to read off the illumination in candle-feet. The apparatus was quite portable; and in a very short time, one could make a number of observations with it. If it was desired to ascertain the effect of an angular ray of light, all that was necessary was to tilt the apparatus in the direction from which the light came; and one got a direct measurement of the angle of light.

Mr. WAINWRIGHT said the author had mentioned that a higher pressure than 8 or 10 inches was more efficient in some of the high-pressure gas installations; but he (the speaker) thought they would find this greater illumination was secured with a loss of efficiency economically. One important question to consider was the mantles. These added to the cost of high-pressure gas lighting if they broke very rapidly; but their life was increased by the use of anti-vibrators. Mr. Fowler had also mentioned the earlier types of water-power pressure-raising apparatus, using the town mains, and did not think much of them, as they required from 188 to 327 gallons per 1000 cubic feet of gas compressed. This had now been considerably reduced; and he had known tests made with Keith's machines which showed 170 gallons. Mr. Wainwright next drew attention to the same firm's devices for permitting the removal whenever necessary, without breakage, of the mantles, and for the proper adjustment of the gas and air. He thought that, without some such arrangement as this, the breakage of mantles was very considerable when, for any purpose, they had to be taken by an ordinary workman off the lamps. Comparing the cost of gas with electricity, he remarked that 100 electric lamps of 16-candle power, using 60 watts each, with electricity at only 1d. per unit, would cost about 6d. per hour; whereas 100 inverted gas-lamps of 45-candle power, consuming 1½ cubic feet each, with gas at 2s. 10d. per 1000 cubic feet, would cost 5·1d. per hour. That was to say, gas gave nearly three times the amount of illumination at about 85 per cent. of the cost of electricity, even when reckoned at as low as 1d. per unit.

Mr. F. W. GOODENOUGH, on being called upon, remarked that he had not very much to say on the paper, but would first of all like to thank Mr. Fowler for his extremely valuable communication, which, as a gas lighting engineer, he (Mr. Goodenough) would

find most useful. It contained a great deal of information, founded absolutely throughout on practice. He was interested in Mr. Lea's photometer, and in his remark as to the necessity of not measuring the light on the floor-level. This always appeared to him (the speaker) to be a mistake; and he had taken 4 feet from the ground, as against Mr. Lea's 3 feet. He took it that the position where light was most usually required was between the floor level and a couple of feet above a man's head. Adopting the mean of this, they would arrive at the point where the light should be measured. Of course, the importance of this point came home to them when they considered the question of the height at which they should fix a light above the floor-level, and the efficiency of the light wherever it was placed. If they put an arc lamp 20 feet above the ground, and took it as being of 500-candle power, they had to divide this by the square of 17 to find the available light on the plane underneath; while if they put a 200-candle power lamp 12 feet high, they had only to divide by the square of 9. They would thus find that the 200-candle power lamp placed 12 feet high was considerably more effective than the arc lamp 20 feet high. Mr. Fowler, in referring to goods yards lighting, indeed, spoke of three-light incandescent gas-lamps of 150 to 200 candles as being practically interchangeable with arc lamps, which might be considered to be of 500-candle power; and it was undoubtedly the fact that, as they could put the incandescent gas-lamps nearer the ground, they were practically as effective as the arc lights. Mr. Fowler throughout his paper seemed to have got at the back of his mind that he wanted a big light a long distance away; and he must have been thinking all the time of the sun, in regard to which the element of cost had not to be considered. But in practice his paper showed that he found that a considerable number of lights placed only a moderate height above the place to be lighted was the most effective and economical means of illumination; and this was where it might be said that gas lighting had such a pull over electricity, because the smaller nominal candle power gave an equally effective light where it was wanted as did the nominally higher power arc lamps which had to be put up somewhere where they served to illuminate the heavens. Mr. Fowler mentioned as an advantage the convenience of being able to switch electric lights on and off; but he would like to point out that at Victoria Station (the contract for lighting which had been secured by the Gaslight and Coke Company), the whole of the gas-lights on the platform were switched on and off by means of control-taps, in just the same manner as was done with electricity. The lamps were on alternate controls, so that they could extinguish every second one by a single turn of the cock, and the remainder by a turn of another cock; and they could, of course, be lighted in the same way. They had thus arrived at the same stage of convenience as the electric light people. Mr. Fowler mentioned, with regard to a small country station, that he would like incandescent burners there; but as the light was only required during a few winter months, although the burners had always to be kept ready for use in case of emergency, flat-flame burners were generally used, to avoid the cost of keeping incandescent burners in order during the summer. A system that might be adopted was an incandescent burner made to fit on to an ordinary Bray flat-flame burner, by means of a sleeve. Directly this was put on, there was their incandescent burner; while in the summer it could be lifted off, and there would still be the flat-flame burner ready for sudden use. He agreed with Mr. Fowler that the Kern burner required more attention than a "C" burner, though it gave a somewhat higher efficiency. Mr. Fowler spoke of a higher efficiency per cubic foot when a pressure of 50 inches of water was used, instead of 8 or 10 inches, with the high-pressure system; but he said "the unit of light was raised higher than was usually required for railway purposes." At Victoria Station, his Company were using a pressure of 50 inches; and they were working with units of light from 175-candle power upwards with no material loss of efficiency as compared with larger burners.

Mr. FOWLER: How many candles do you get per cubic foot?

Mr. GOODENOUGH replied that with a 5-feet burner, they got about 33 to 35 candles per cubic foot; and with a 10-feet burner, from 38 to 40 candles. He had got as high as 45 candles per cubic foot; but this was rather a "freak" result, and from 38 to 40 candles was the normal reading. He thought Mr. Fowler would like to know that they could get down as low as 175 candles even at 50 inches pressure. The system was that adopted at Woolwich Arsenal—the Sale-Onslow. Mr. Fowler referred to a small type of inverted burner giving an economical light of 12 candles; but just afterwards he gave a table in which the smallest candle power was 25. He must have been under-rating the inverted burner when speaking of 12 candles, which would be an extremely low efficiency. He would like also to take exception to Mr. Fowler's statement that for the lighting of the offices, &c., of a station incandescent electric lamps were quite satisfactory, "as in many cases an 8-candle power electric lamp over a desk was all that was required." Any employer who expected his staff to work with a nominal 8-candle power lamp as the only source of light, was doing his best to blind his employees; and he believed that great destruction to eyesight was caused by using so-called 8-candle power lamps—probably giving a light of 5 candles—instead of having a well-diffused light of (say) 30 or 40 candles placed rather higher up to work by.

Mr. FOWLER, replying to the discussion, said he would like to make a few remarks with regard to what Mr. Trotter had stated at the last meeting. He questioned the use of oil-lamps, when the arc lamp was the most economical from a candle-hour standpoint. But, as Mr. Hughes had said, they had to deal with small units; and they did not want arc lamps at country stations. The most inefficient lamp used on a railway was a small signal lamp which gave 1-10th candle power; but at the same time it was undoubtedly one of the most economical lamps, because it gave all the light that was required. They paid at a high rate for a small light. The curves given in the paper were taken at 9 inches from the ground. He would like to join issue with Mr. Lea and Mr. Goodenough on this point. If they had the floor illuminated properly—or, say, 9 inches above it—then the lighting was all right elsewhere. He was, of course, speaking specially of the lighting of railway premises and workshops. Undoubtedly, the floor was the point one looked at first; and in any workshop there were often small things to be picked up and dealt with on the floor. The same applied to a railway station. There was one point apparently he did not make himself quite clear on in the paper. By horizontal and vertical illumination, he meant on horizontal and vertical planes; and when the horizontal was right on a railway, the vertical was also right in the majority of cases. The only exception he knew of was in the case of shunting-sidings where waggons passed quickly, and the numbers were chalked on the end. There they made special arrangements for illumination on the vertical plane, so as to throw a light on the ends of the waggons. Mr. Trotter now believed in patchiness for street lighting. This might possibly be all right for streets; but it was not, generally speaking, for a railway. The only case where light might be patchy was with points in sidings under some conditions. In this case—as Mr. Goodenough had stated, and as he had hoped he had made clear in his paper—a light of 100-candle power was quite sufficient; and therefore it was unnecessary to have 1000-candle power. It was on this point that gas had pushed electric light. At one time, there was nothing for use between the 16-candle power electric incandescent lamp and the high-power arc; whereas now there were very many intermediate types in use. He had not time to deal with his own photometer and Mr. Trotter's; but he should like to speak in appreciative terms of the latter. In connection with these portable photometers the question of weight was important; and Mr. Trotter had, he thought, made his even lighter than the amyl-acetate one which he (Mr. Fowler) used. In the paper he mentioned Sheffield Station as being one of the best-lighted stations on the system; and he had had some photographs taken which might interest the members. Since the paper was written, they had made considerable alteration in the lighting of one of their sheds by the use of high-pressure gas-lamps, with very satisfactory results. As to Mr. Praed's remarks about carburetted air, they had had a system working for about twelve months which gave better results than they had secured at the time the paper was written. He could assure Mr. Praed that the railway companies were wholly disinterested in this matter, and would watch with interest what was being done. He thought that probably the reason they got unsatisfactory results by passing carburetted air gas through acetylene pipes was that the latter were much smaller than were required even for ordinary gas, and to obtain a proper light from petrol gas it was necessary to have pipes that were larger in diameter. With regard to Mr. Wainwright's remarks about incandescent mantles, he thought when a skilled man looked after them there was no difficulty. They had every year a function at a hall situated a mile from the station at Derby, and they used mantles there, and then took them off again and placed them on burners at the station. Some time ago, the King went to one of his Company's stations, and they put up some special lamps for the purpose, which were not needed afterwards; and so the mantles were removed from them, and put on somewhere else, a long way off. The fragility of the mantle could be met to a certain extent by the carefulness of the man. He might mention that the water compressing plant which used over 300 gallons per 1000 cubic feet of gas compressed was very old. One of the troubles of plants driven in this way was the possibility of the water being cut off; and then the light would nearly go out. Mr. Goodenough was quite right in saying that he (Mr. Fowler) had the sun in his mind as being an ideal light; and for shop lighting, he thought that, with an expenditure of a little more gas, one could get more satisfactory results by having the lights high. Mr. Evered, in speaking of the Kitson light, said they had a device by means of which the lamp was fastened to a jib crane, and when the crane came along, it threw the lamp round; and then afterwards the lamp swung back again into position. But he (Mr. Fowler) did not think this was necessary. It was better to have the light higher up and permanently fixed, because what they wanted was a general illumination, and not the lighting of a particular point. He asked Mr. Goodenough how they switched the lights on and off at Victoria Station, because no method that he had tried had lasted for any time.

Mr. GOODENOUGH explained that they had an independent low-pressure service, and a mercurial seal on each down-rod, which automatically closed the gas-ways when the main-tap was turned off.

Mr. FOWLER (continuing) said he thought he had worked underneath an 8-candle power electric light; but this one had a reflector at the top, and he had not experienced any difficulty. But undoubtedly the question of lighting was one that grew. An American humorist had said that, whereas our grandfathers were satisfied with one candle in a room, our children would not be content unless they had an arc lamp over each shoulder.

LONDON AND SOUTHERN JUNIOR ASSOCIATION.

A Lecture on Flame Temperature.

The members of the London and Southern District Junior Gas Association turned up in considerable force—the audience numbered about fifty—at the Cripplegate Institute, E.C., last Wednesday, for the purpose of hearing a lecture by Mr. W. H. Y. WEBBER on "Flame Temperature in Its Practical Aspects." The chair was occupied by the President (Mr. W. Upton), who, in introducing the lecturer, said he did not know a subject on the technical side that was of greater importance than the one they were going to hear dealt with.

In his opening remarks, the speaker cautioned his hearers against wasting their money and time on old text-books, though he admitted that there was, of course, much that they must learn and have by them for reference which never grew out of date—such as arithmetic, mathematics, geometry, mensuration, and the tables of properties and constants appertaining thereto. But they should never buy encyclopedias or subscription books with tempting prospectuses, which were necessarily out of date before they were published. The newest of any text-books that they felt in need of, official publications, such as Blue-Books, the notifications of authorities like the Metropolitan Gas Referees, the Transactions of societies, and the Technical Press, would be found of greatest use to them. With even the latest and most expensive text-book, however, he pointed out that they must be prepared for the passing over of many things that they particularly wanted to know, and the stopping short of others precisely where the author's criticism would become helpful. He cited the seventeenth edition of Ganot's work on Physics, dated 1906, and edited by Professor A. W. Reinold, as affording an instance of this; the calculation of flame temperature not being dealt with there in the manner that a student buying an expensive text-book had a right to expect. "Yet," said Mr. Webber, "Professor Reinold must have known quite well that the question of the real temperature attainable by flaming combustion lies at the bottom of a large and highly important body of technic. Metallurgists want to know what to expect from the gaseous fuels at their command. Manufacturers of the harder kinds of porcelain and glass goods need the information. The whole body of incandescent gaslight practice depends upon the fact of high flame temperature. Lord Rayleigh, among others, pointed this out years ago. Yet the uninstructed, fumbling makers of this light, like Mr. A. W. Onslow, are fain to go on with their work in their own way, without the smallest help or guidance from the magnates of science."

Reference was then made to the researches of Professor Vivian B. Lewes and Professor Arthur Smithells. Mr. Webber remarked that Professor Lewes, in his lecture to the Institution of Gas Engineers on "Candles and Calories" in 1903, laid stress upon the fallaciousness of the idea that the temperature of the flame was governed by the calorific value of the gas. Professor Lewes stated that the temperature of the flame produced by the combustion of a sample of gas depended (1) upon the time in which this volume of gas was consumed, (2) upon the area in which the combustion took place, and (3) upon the amount of air needed for completing the combustion, and the specific heats of the products of combustion of the flame and the residual nitrogen from the air, which in their escape removed heat from the flame. This "affect," as it might be termed in philosophical language, of flame temperature, he concluded, was the important thing in incandescent gaslight production. "Professor Lewes," continued Mr. Webber, "described certain experiments showing for blue water gas, purified from CO_2, with a calorific value of 325 B.Th.U. net, a light efficiency in the Welsbach 'C' burner of 19·38 candles per cubic foot hourly consumption at 13·10ths pressure. The illuminating power of the light in this case was 158 candles for a consumption of 8·15 cubic feet per hour. Observe here the satisfaction of all the conditions previously laid down by Professor Lewes as governing flame temperature. We start with a particular size of substance to be heated by the flame—to wit, a 'C' mantle. If this mantle were heated as in the ordinary way by a flame of mixed town gas and air, the former having a calorific power of 540 B.Th.U., or thereabouts, and burned at the rate of 4 cubic feet per hour, which would just about fill it, the same average duty per cubic foot of gas might be expected—meaning, that the mantle would be at approximately the same temperature. The amount of air required for complete combustion would be nearly double. The high temperature attained by the water gas is therefore due to the comparatively smaller size of its flame. Professor Lewes puts the flame temperature of coal gas here at about 1660° C. (which is low); and quotes Blass for a water-gas flame temperature of 1775° C. It was also shown that a temperature sufficiently high to yield a brilliant light at 20·10ths pressure can be attained, by careful air regulation, with an exceptionally good quality of producer gas of 184 B.Th.U. net calorific power. But meanwhile others had been busy upon the problem of the connection between the calorific power of gases and their value for the production of incandescent light by the Welsbach mantle. Dr. Bunte, Dr. Colman, Mr. F. D. Marshall, and others, independently hit upon the same guiding principle—that within the ordinary range of differences in the calorific value of town gas, of various makes, the duty obtainable from the gas and a mantle is about the same—adjustment of the air supply being understood. Mr. W. R. Herring has also carried the same discovery to conclusive demonstration."

Coming to Professor Smithells' work, the lecturer referred to his address in 1905 to the Institution of Gas Engineers, on "The Temperature of Flames," in which was explained why the classical rule for calculating flame temperatures had no correspondence with the facts. Professor Smithells described how Bunsen made a shot at the problem, with results far from correct; and he proceeded to explain the phenomenon of dissociation, and most instructively indicated the part played by it in making mixed flames as thick as they were. That was to say, as he (Mr. Webber) understood him, it was due to the deferred combustion effect of dissociation that the flame of a Kern or a Mecker burner was not a mere filmy appearance at the zone of ignition, as would be the case if the mixed gases could burn all at once at the initial temperature of their combustion. Professor Smithells thought that flame temperature calculation could be carried out, but did not offer any examples; and the broad result of all the study he (Mr. Webber) had been able to devote to the problem was that he could not ascertain from its composition what degree of elevation of temperature to expect from the burning of a particular sample of combustible gas or mixture of gases, while on all sides he heard complaint of the want of this information.

By means of fine strips of wire, and some bunsen burners which were fitted up in the room, the lecturer next demonstrated the fact that the temperature of flames varied greatly in different parts; and he also quoted figures on this point. Taking a common laboratory bunsen flame, with an air adjustment, enabling the inner cone to be varied from the blue tint of under-aeration to the green of approaching back-lighting, Professor Lewes gave the following as the measured flame temperatures:—

	With Blue Inner Cone.	With Greenish Inner Cone.
At tip of inner cone	1994° Fahr.	2867° Fahr.
Centre of outer cone	2791° ,,	2966° ,,
Side of outer cone, level with tip of inner cone	2431° ,,	2752° ,,
Proportion of air added to the volume of gas	2·27	3·37

Tests made at the National Physical Laboratory on the same subject showed—

Temp. of Centre of Flame at	Ordinary Bunsen.	Mecker Bunsen.
2 mm.	100° C. (212° Fahr.)	1520° C. (2768° Fahr.)
10 ,,	100 ,, (,,)	1470 ,, (2646 ,,)
20 ,,	150 ,, (302 ,,)	1460 ,, (2596 ,,)
40 ,,	500 ,, (932 ,,)	,, ,, (,, ,,)
60 ,,	1100 ,, (2020 ,,)	1470 ,, (2646 ,,)
80 ,,	1350 ,, (2462 ,,)	1430 ,, (2351 ,,)

Pointing out that the hottest part of the flame in ordinary bunsen burners was in the solid region over the inner cone, while the Mecker flame was solid, and hottest at the bottom, Mr. Webber said this went to support the "dissociation" explanation. He remarked that other observers gave different maxima for these bunsen flame temperatures, and then proceeded to consider the question of the temperature of a mantle as compared with that of the flame in which it was plunged. Assuming that the mantle possessed a sensibly greater heat than the gas-flame, he asked whether this was due to the catalytic action of the mantle (as Professor Lewes once thought), or whether it was caused by the purely mechanical effect of the meshes of the mantle in completing the mixture of air and gas, presenting the mixture from inside to the rapid action of the outside or secondary air in such a fine state of division as to secure the best possible final combination. He himself believed there was much in the latter explanation, and that those who studied inverted incandescent lights and their activating bunsen flames would agree that the mantle did something else besides glowing. Returning to the lecture of Professor Smithells, Mr. Webber remarked that one of the valuable observations contained in it concerned the relationship between flame volume and flame temperature. With gas burning at a fixed rate, the smaller the volume of the flame, the higher must be its temperature. Professor Smithells explained that the way to get a small flame was to have it mixed primarily with the largest possible portion of the air it required for its combustion. This effect, said Mr. Webber, was strikingly exemplified by the Mecker burner. The Kern burner also exhibited compression of the flame; while its formation was specially moulded to the object for which it was made. The Bray and Sugg mantle-burners were designed somewhat on the same lines. Professor Harold B. Dixon pointed in the same direction in 1904, when he said that "the burning of a highly explosive gas mixture is one of the best means of developing light from gas;" the light-giving power, of course, being synonymous with high-flame temperature.

Continuing on this branch of his subject, the lecturer remarked: The question of getting as much primary air as possible into the burning mixture was worked at by the late Mr. Frank Livesey, and by Mr. Walter Grafton, your ex-President, and it underlies the "Selas" system of intensified lighting. In point of fact, what all the high-pressure incandescent gas lighting systems now before the world do, is nothing more or less than make the best mixture of gas and air possible, and drive the flame through the mantle at a high velocity. There is no actual pressure within the mantle; the pressure of the gas in the pipes being translated by the injector into velocity. This means, according to Professor Lewes's formula, burning more gas in the time and space, which is one way of raising the flame temperature, and so producing

more brilliant incandescence. The degree of elevation of temperature attainable by this method depends upon several factors. How far the pace can be profitably forced, having regard to economical considerations, is another question again. Some tell us that, in the general way, an intensity of incandescence corresponding to a supply pressure of from 15 to 17 inches of water is enough. Other practitioners prefer to work at 54 inches pressure, which means double-wove mantles. So far as I know, this is the maximum for lighting burners. Mr. Onslow has kindly made, at my request, some comparative observations by means of the Féry pyrometer, of the temperature of incandescent mantles. From these, it appears that, as might be expected, the thermal radiation rises with the luminous intensity.

RADIANT TEMPERATURE OF INCANDESCENT GAS-MANTLES, IN DEGREES CENTIGRADE.

"C" Burner with Chimney giving 60-Candle Power. [Length of Mantle from Loop to Burner, 3⅛ Inches.]		Same Mantle *without* Chimney, 50-Candle Power.
Temperature at the top	480 to 500	560
,, 1½ inches from the top,	490	560
,, 2½ ,, ,,	470	610
,, 2⅞ ,, ,,	450	570
,, 3¼ ,, ,,	400	520

600-Candle Power High-Pressure Burner. High-Pressure Gas-Mantle with no Glass Protection. [Length of Mantle from Loop to Burner, 4¾ Inches.]		Same Mantle under Different Illuminating Power.	
		900-Candle Power.	400-Candle Power.
Temperature at top of mantle	730	700	675
,, 1¼ inches from the top	735	705	680
,, 2½ ,, ,,	740	710	685
,, 3¾ ,, ,,	745	720	690
,, 4¾ ,, ,,	755	730	705

High-Pressure 1000-*Candle Power Burner.*

[Length of mantle, 5⅜ inches from loop to burner.]

1000-Candle Power.		500-Candle Power. First Test.	5 Mins. after First Test.	800 C.P.
Temperature at top of mantle	710	690	690	690
,, 1½ inches from top.	720	710	690	695
,, 3 ,, ,,	730	720	700	790
,, 4½ ,, ,,	725	720	705	705
,, 5⅜ ,, ,,	720	715	700	700

High-Pressure 250-*Candle Power Burner.*

[Length of mantle, 3½ inches.]

265-Candle Power.		250-Candle Power. First Test.	After 5 Min.	200 C.P.
Temperature at top of mantle	630	630	630	610
,, 1 inch from top	630	630	630	610
,, 2 inches ,,	630	630	630	610
,, 3 ,, ,,	645	650	645	620
,, 3½ ,, ,,	650	645	635	625

The uniformity of the 1000-candle power mantle temperature may be due to the mantle tapering from the bottom to a narrow neck; whereas the 600-candle power mantle is almost the same diameter throughout the length from 4¾ inches to within 1 inch of the top. This looks as if the two radiations, thermal and luminous, in the case of all the high-pressure mantles are of about the same proportions; the greater illuminating powers being due to the larger mantles of the more powerful burners. But the difference of the proportionate thermal radiation between the Welsbach "C" mantle and the intensified mantles is marked. I draw your attention to the remarkable fact that, though the local temperature at the mantles in these burners is higher than the melting point of platinum, which is 1775° C., the pyrometer only finds a temperature inferior to this by about 1100° C. This circumstance alone warns us that the measurement of flame temperature is not a simple task.

But this is not the whole of the story. Indeed, it is but the preface to the volume that has yet to be written upon the enthralling subject of the practical working aspect of flame temperature. The intensity of flame temperature may not be easily ascertainable by the classical method of calculation from the calorific value and the weight and specific heat of the combustion products, or by actual measurement; but it is very greatly affected by the proportion of incombustibles intruded upon it. The presence of nitrogen cannot be helped if we must burn our gas with air; but if oxygen were cheap enough, as Professor Dixon has remarked, it would be easy to increase the temperature of the flame by 500° or 600° Fahr.; and as radiation increases as the fourth power of the absolute temperature, the light duty of the same mantles that are now in use would probably be raised to 100 candles or more per cubic foot. On the other hand, admixture of an impurity having a high specific heat, as CO_2, is fatal to the attainment of the highest temperatures.

Another important conclusion to be drawn from this survey of the means of producing high-flame temperatures is that of the futility of the regenerative principle for this purpose. The effect of heating a gas is to dilate it, which is tantamount to diluting it. In the case of the Siemens type of regenerative burners, which worked at very low pressure, and had a luminous flame, the increased radiation due to raising the temperature was accompanied by extension of the radiating area of the flame. This is impossible with an incandescent mantle, which is of fixed dimensions; so that if the supply of gas and air is rendered bulkier by preliminary heating, regenerative or otherwise, the effect of the mixture in passing through the meshes of the mantle must be so much weaker that any possible gain by one way is more than neutralized by the loss on the other. Indeed, in the interest of concentrated action on the mantle, it would be better to condense the air and gas by cooling, than expand them by heating.

Mr. Webber concluded his lecture with a few remarks on the question of flame temperature as applied to heating by gaseous fuel. He said that the next resource to the weak and uncertain producer gas was plain water gas, which, though its flame temperature was high, was troublesome to make and dangerous to distribute. There remained, therefore, ordinary town gas, as the gaseous fuel of unexceptionable utility for most industrial purposes demanding an intense, rapid, and localized heat. For this use a higher gas pressure than anything employed for lighting was found advantageous. Coal gas averaging about 540 B.Th.U. net calorific power, with a fire-brick lined cupola-shaped furnace, worked wonders, for instance, in rapid steel annealing at a pressure going up to 100 inches. This was a matter of flame temperature—which, however, had not yet been measured. Consequently, no man knew precisely, or even approximately, what town gas would ultimately do for the service of man.

A vote of thanks to the lecturer was accorded with acclamation, on the proposition of the President, who said that what they had heard was most interesting. Mr. H. Rothwell seconded the vote; saying they all appreciated Mr. Webber's kindness in devoting, as he had done, his time and energies to the Association.

The President, after inviting the members to make any remarks or ask any questions that they might wish to, said that there were one or two points arising out of the lecture that had struck him. Mr. Webber had shown them an inverted burner in operation, and mentioned that with it the object was to keep the shaft cool. He (the President) had not particularly tested the burner exhibited; but he had a good many other types, and had noticed that the burners, after they had been lit for perhaps a minute or two, would most noticeably increase in light-giving power. Another point was that there was a constant tendency in their business for the units of light to become larger and still larger. Up to the present these had been obtained by grouping several burners in a lamp; but the demand for more light would continue, and he wished to know whether the existing system of grouping would be the correct one to adopt, or whether there were to be larger mantles and burners. This was a matter to be thought over; and as it involved the question that had just been dealt with, the lecture was most opportune. If they had very large units, they might come up against the same trouble as the electricians, with their several thousand candle power (reputed) lights, and have to soften them down considerably. Mr. Webber said he would answer the first point at once. He thought the effect the President spoke of—assuming it did exist—was due to the fact that the inverted burners were adjusted to what would happen when they had been lit for two or three minutes, rather than to what would occur directly they were put in use. Of course, they must get a little hotter in use; and if they were made to be perfectly right when cold, they would not be so when hot. Therefore he thought they were arranged to be not quite right when first lit up. The proper shading of inverted lamps was not always understood. The globes should be more deeply coloured at the bottom than in the other parts, so as to throw out more light towards the top. He had seen it stated that the inverted lights could not be turned down; but they could be, to a very considerable extent. Mr. J. Hewitt also referred to the President's question, and asked Mr. Webber whether he considered that the effect of the heat on the nipple had anything to do with the increased light given by inverted burners after some two or three minutes' burning. Even an ordinary upright Kern burner, he said, consumed a different quantity of gas with a cold nipple from what it did with a hot one—that was, if the nipple was made of brass. He believed steatite was now being used in some cases. Probably this difference would have an effect on the mixture, and produce an increased illuminating value. Mr. Webber remarked that, if there was any alteration, he thought it was allowed for by the makers. The nipples were very carefully manufactured to the one-thousandth of an inch gauge.

Among the other speakers was Mr. F. Ainsworth, who said he thought the lecture would be the means of helping a good many of them to go more thoroughly into the matter dealt with. He asked whether the mantle had not more to do with the increase of light after a burner had been going for a time. Then with regard to the solid flame and the cone flame, which was best, and likely to consume the least gas, in rendering the mantles thoroughly incandescent? What pressure did Mr. Webber think was best for bunsen atmospheric burners of various types if used in gas-fires? There were different views with regard to the pressure of gas for heating as well as for incandescent lighting. Mr. E. W. Eldred said that he had seen an inverted burner with an entirely closed globe; and he had been asked how it was that this burner was able to burn satisfactorily without assistance—apparently taking all it needed from the air-adjuster. He asked what was the best position for the air-inlet. As to the nipple question, he did not think the heating was sufficient to cause any alteration in the gas consumption. He believed the smaller consumption was due to the expansion of the gas and heated air going through the nipple. It was not owing to the lessening of the hole in the nipple. Mr. L. F. Tooth said that Mr. Webber had made some remark as to the preheating of gas, and had stated

that the lighting efficiency was thereby lessened. He (Mr. Tooth), however, found that it was increased, providing the size of the nipple and the mixing-tube was increased. He had made some tests with preheated gas, which showed that a cold Kern burner with cold gas passed 12½ per cent. more than with preheated gas. As to turning the inverted burner down, this could be done with a single unit or a single burner; but with church lighting there might not be a uniform pressure over the whole building, which was the cause of burners flashing-back, carbonizing, &c. With reference to the flame of an inverted burner being somewhat smaller at the commencement of lighting, it seemed to him that this was caused by the velocity of the gas not having drawn in sufficient air to fill the chamber. Mr. W. J. Liberty asked at what stage between an ordinary high pressure of (say) 15 inches and one of 50 inches or more would it be necessary to increase the strength of the mantles from single wove to double wove.

The next speaker was Mr. Walter Grafton, who said he would like to make a few remarks upon one or two points raised by the members. As to why an inverted burner gave a better result after a few minutes' burning, Mr. Tooth was right to a very large extent. The rate of gas was nearly the same through the orifice in a properly constructed burner; but the quantity of air was lessened. Therefore in cases where the gas was not wholly coal gas, but a mixed gas—particularly carburetted water gas—it was necessary to have a sleeve, so as to cut off a portion of the air. It was only by this means that they could secure a full-sized flame. Or on first lighting the burner with the air-adjuster in the position as used on a previous occasion, the gas should be turned on to give not quite the best result; but in two or three minutes the full power of the light would be obtained—clearly showing that the volume of air was reduced by the heating of the burner. As to whether a burner would pass more gas when hot or cold, he might say that it would pass from 5 to 15 per cent. more when cold. When they had a flame burning immediately at the outlet of a burner, there was a retardation. An inverted burner with an entirely closed globe and with air only primarily supplied to it would not burn for very long; a supply of air outside the mantle was essential to obtain the best results. The secondary air supply came in above the globe. In properly adjusted burners, any pressure over 8 inches caused the efficiency per cubic foot to gradually become less, and also the life of the mantle, which must be taken into account when supplying gas at high pressure.

In his reply, Mr. Webber remarked that Mr. Grafton had very kindly answered several of the knottiest questions. He was interested in what Mr. Grafton had said about the different flow of gas from burners when they were alight and when they were out of use and cold; and he asked whether he thought that it would apply also to the incandescent burner. Mr. Grafton replied that he had measured the quantity with flat-flame burners, both single and double hole; and the same thing would apply to inverted burners. And since there was less gas, there was also less exhaust or suction; and consequently less air was drawn into the bunsen tube to blend with the gas, producing thereby a larger flame and better illumination. Mr. Webber (continuing) said that the pressure of the gas always remained the same to an inverted burner; but it was a different thing with the air, and so the temperature of the tube had a good deal to do with the matter. As to the best pressure for fires, no doubt this would be a very "ticklish" question in the near future. He did not think they had yet bottomed the construction of the gas-fire; and what sort of flame, and what pressure, would eventually prove to be the best, were, he thought, subjects that they had not really begun to consider. With regard to single and double mantles, he believed Sugg's light at from 15 to 17 inches pressure had a single mantle; and the Sale-Onslow at some 50 inches, and the "Millennium" lamp at the same pressure, a double one. There was, however, a big gap between these figures. The strength of the mantle was required to resist the friction of the gas passing through the meshes, as much as the intensified heat. Some people thought that from 15 to 20 inches was quite sufficient pressure for all practical purposes; while others believed in a higher pressure. There was no doubt that they must have the most intense radiant that they could get. He did not know the inverted burner with the closed globe. The best place for the injector was as far from the spot where the gas was burnt as they could reasonably get it. He did not know anything about preheated gas; it was not a commercial article. No method that involved the systematic preheating of gas had ever succeeded. The regenerative system, of course, was more a case of heating the air than the gas—it was about six to one.

"Departmental Decisions."—We have received from Mr. S. Edgecumbe Rogers the issue of the above-named work for the quarter ending December last. It is the fifth of the series, and contains altogether 142 decisions by the Board of Education, the Home Office, the Local Government Board, the Board of Trade, the Post Office, the Registrar-General's Office, and the Treasury; those of the Local Government Board being the most numerous. They are all numbered, so as to make them easy for reference; and, inasmuch as they are not only legal interpretations of law by the departments concerned, but form precedents which govern similar cases wherever they occur, the book should be found useful by all engaged in the administration of local government.

NOTES ON INDIRECT ILLUMINATION.

A brief note appeared in a recent issue of the "Journal für Gasbeleuchtung," from the pen of Dr. E. Schilling, of Munich, discussing some figures given a short time before by Professor L. Weber, of Kiel, in the "Zeitschrift für Beleuchtungswesen," relating to the illumination in a room experimentally provided with indirect lighting from incandescent gas-burners, and also dealing with some figures given by Dr. Reibmayr, of Innsbruck, on the subject of the light in several rooms illuminated with electric glow lamps and incandescent gas-burners respectively.

Professor Weber's measurements were made in a small furnished room in the Physical Institute belonging to the firm of Julius Hardt, of Hamburg, which was 19 ft. long by 14 ft. 7 in. wide by 13 ft. 7 in. high, fitted with a double lamp supported 2 feet below the centre of the whitewashed ceiling. The lamp comprised two Hardt gas-burners which developed 105·5 and 130·5 horizontal candle power, from a consumption of 5·5 and 6 cubic feet per hour; the total light being thus 236-candle power for a consumption of 11·5 cubic feet. The measurements of the illumination were made on surfaces 3 ft. 7 in. above the floor; the surfaces being sometimes horizontal and sometimes vertical. The results obtained are given in Table I.

TABLE I.

—	Under the Light.		In the Corners.	
	Horizontal Surface.	Vertical Surface.	Horizontal Surface.	Vertical Surface.
Without reflector. . . .	2·50	0·43	2·22	0·95
White enamelled reflector pointing upwards . . .	2·76	0·46	1·95	0·83
Do. provided with sectors of mirror glass. . . .	3·18	..	2·32	..

The author's figures have been converted from metric into British data, on the basis that 11 Hefners are equal to 10-candle power, and that 1 Lux is equal to 0·0845 candle-foot.

In discussing the results, Professor Weber remarked that the reflector which is necessarily employed under the naked lamp when the indirect system of lighting is adopted, by no means reduces the average illumination, but actually increases it. This is due to the fact that a large portion of the unshaded light from the lamps would pass directly to the dark floor and lower parts of the walls, where it would be absorbed; whereas the white reflector throws the rays upon the white ceiling, whence they are reflected, reinforcing the light that naturally proceeds downwards.

It will be seen that, when the white enamelled reflector was employed, the average horizontal illumination was 2·52 candle-feet for a consumption of 11·5 cubic feet of gas per hour, in a room having a floor surface of 300 square feet. Hence per square foot of floor surface an illumination equal to 2·52 candle-feet at a distance of 3 ft. 7 in. above the floor was afforded by the development of 0·786 candle power from 0·0386 cubic foot of gas. Professor Weber proceeds to compare the cost of the illumination thus obtained from gas with the consumption of electricity in Tantalum lamps, such as were used in Müller's experiments in the Bremen Technical Institute, in a room having the walls white all over. Müller found the current consumed in the provision of an illumination equal to 2·52 candle-feet to be 1·235 watt-hours per square foot; whence, taking gas at 5s. 6d. per 1000 cubic feet, and current at 6d. per B.T.U., the cost of the electric light was 2·8 times that of gas lighting.

Professor Weber also referred to the experiments that were carried out in the Technical High School at Munich two years ago, and to the conclusion that his own tests would make the cost of gas lighting 2·5 times as high as was found to be the case in Munich. As a matter of fact, however, the Munich results showed that illumination equal to 2·52 candle-feet could be obtained from a consumption of 0·0427 cubic foot of gas per square foot of floor surface—a result which, in spite of the entirely different conditions during the experiments, is sensibly identical with Professor Weber's own figures. It is also worth noticing that the Munich results have been substantiated by Professor Roth, of Zurich, as well as by Professor Weber himself; and therefore it may be confidently said that illumination obtained from Tantalum lamps is 2·8 times as expensive as indirect illumination with incandescent gas.

Some interesting experiments have also been carried out by Dr. Reibmayr upon the illumination present in rooms of various sizes provided with either gas-burners, or electric glow lamps, and lighted either directly or indirectly. The electric lamps were surrounded with egg-shaped shades of translucent ribbed glass, and were supported close under the ceilings symmetrically in respect of the rooms. The measurements of the illumination were made at the level of the desks, which in certain rooms were arranged in tiers. The glow lamps were of two nominal sizes, "16-candle power" and "32-candle power" respectively. The details of Dr. Reibmayr's work are recorded in Table II. Unfortunately, the amount of current consumed during the tests was not noted. The figures relating to the loss of light when the

TABLE II.

Room.	Number of Lights.	Illumination in Candle-Feet.			Ratio of Minimum to Maximum Illumination.	Percentage Loss of Light through Shadows.		
		Mean.	Max.	Min.		Mean.	Max.	Min.
Laboratory (730 sq. ft. by 13 ft. 6 in. high)—								
(*a*) Ceiling lights of 32-candle power glow lamps	12	2·91	3·28	2·20	67	9·8	33·0	4·0
(*b*) ,, ,, 10 ,, ,, ,,	12	1·15	1·34	0·95	70	..	..	..
(*c*) Indirect lighting with 32 ,, ,, ,,	12	2·17	2·49	1·82	72	9·1	27·3	1·5
(*d*) Cluster ,, ,, 16 ,, ,, ,,	8	1·15	2·24	0·59	27	23·9	67·1	10·0
Private room with dark wainscoted walls (386 sq. ft. by 11 ft. 6 in. high)	1 of 46 c.p. 1 of 29 c.p.	1·11	1·93	0·38	20	43·5	..	..
Indirect lighting by Welsbach burners—								
(1) Small class-room (550 sq. ft. by 12 ft. 2 in. high)	6	2·69	3·82	1·77	45	10·7	17·5	3·9
(2) Large ,, ,, (970 ,, ,, 12 ft. 2 in. ,,)	12	2·02	2·61	1·37	53	12·5	15·9	5·3
(3) Room for drawing class (1020 sq. ft. by 12 ft. 2 in. high)	20	2·70	3·56	1·52	43	17·3	29·0	2·5

indirect system is employed, owing to the longer distance the rays have to travel and the absorption by the walls, is much smaller than in the case of the ceiling lamps. On an average, the illumination values are reduced in this way by 31·1 per cent. The direct ceiling lights might be expected to yield somewhat darker shadows; but actually they are not inferior to the indirect lights either in distribution or in the matter of casting shadows.

Dr. Reibmayr has drawn the following conclusions from his own investigations: Ceiling lamps give a light which answers all the hygienic requirements of interior illumination, more especially for schools, lecture-halls, and drawing-class rooms. They yield a perfectly satisfactory illuminating effect from the candle power developed; and, particularly when electric glow lamps are used fed with current from a large generating station, the light is very constant. The ceiling lamps afford a light which is certainly not less efficiently distributed than the illumination from indirect lights; and they do not expose the eyes to luminous objects of excessive brilliancy. The loss of light through the formation of shadows is insignificant; and since the shadows do not possess sharp edges, they are not annoying to the occupants of the room. The high situation of the lights prevents the occupants from being dazzled or inconvenienced by the radiant heat—the light sources, indeed, being well above the line of vision. Contamination of the air and production of much heat are absent in the case of electric glow lamps, which have also the advantage of being easily and quickly switched on and off. As the light sources are numerous and small, the illuminating effect is elegant. Dr. Reibmayr also adds that, in his opinion, frequent distempering of the ceiling in pure white is not so necessary when high direct lights are employed as when the system of illumination is indirect. This economy and the small quantity of candle power necessary to afford the requisite illumination, help to reduce the high cost of the glow lamps.

Dr. Schilling concludes his article by saying that it would be most interesting if figures were given by Dr. Reibmayr bearing out his assertions relating to the costs of the two methods of illumination investigated by him. As mentioned above, Professor Weber showed that indirect illumination from gas was 31·1 per cent. cheaper than from Tantalum lamps; so that direct electric illumination should be always about twice as expensive as indirect illumination from incandescent gas-burners.

SCOTTISH JUNIOR GAS ASSOCIATION.

Eastern District.

A Quarterly Meeting of the Eastern District Section of the Association was held in Heriot-Watt College, Edinburgh, on Saturday afternoon—Mr. W. BROWN (Lasswade), the President, in the chair.

The PRESIDENT said that, as this was the first opportunity they had had of seeing one another in the present year, he begged to express the hope that they, as members of the Scottish Junior Gas Association, might aspire to greater things in 1907 than they attained to in 1906. They could not stand still, and he thought he was safe in saying that those who made it a practice to attend the meetings reaped the benefit of hearing other views than their own as to how things should be done.

The business was then proceeded with.

Mr. H. RULE (Falkirk) read the following paper on

STOKING MACHINERY AT THE FALKIRK GAS-WORKS.

The advent of any new form of stoking machinery is sure to interest those who have the management of medium or large sized gas-works; and it is with pleasure, at the request of your President, that I now come before you with a description of the stoking machinery used at Falkirk. Before describing the machinery itself, and for the benefit of those who have not seen the works at Falkirk, I might mention that our carbonizing plant consists of 20-feet through retorts, eight in the oven, and each oven heated by a regenerative furnace situated on one side of the bench only. By this arrangement the whole operation of charging and discharging retorts is done from one side of the retort-house, by the projector type of charging and the pusher type of discharging machines; the hot-coke conveyor being on the side opposite that of the stoking-machines. This principle of working, although not so general in Scotland as in England, has proved with us to be a very convenient and economical method of carbonizing. The stoking-machines are, as is well known, the first of their respective kinds made by Messrs. R. Dempster and Sons, Limited, of Elland, Yorks. [Illustrated descriptions of these machines have already appeared in the "JOURNAL." See Nov. 22, 1904, p. 608; May 16, 1905, p. 429; Oct. 10, 1905, p. 114; Feb. 6, 1906, p. 356; April 17, 1906, p. 162; May 15, 1906, p. 443.]

The charging-machine (Toogood's patent) consists of eight steel plates loosely pivoted to a central shaft, and having variable speed automatically imparted to each plate as it revolves; being slower at the inlet—viz., about 400 feet per minute—and gradually accelerated until it approaches the maximum of 2000 feet per minute at the outlet. The action is thus directly comparable to a sling gathering the coal at a comparatively slow rate of speed, and ejecting it at a velocity sufficient to charge the 20-feet through retort. The machine when charging a retort with coal of an average quality revolves at a speed of 70 to 40 revolutions per minute—that is to say, it only takes about 50 revolutions of the machine to completely charge the retort. This is, of course, brought about by the motion imparted to the blades. The outcome of this slow rate is that the wear and tear on the internal mechanism is reduced to a minimum. The machine has already dealt with about 17,000 tons of coal, or 65,000 charges. The wear and tear on the original parts has been quite negligible; and the machine is able to do a considerable amount of work yet. The blades of the charger are 7-16ths inch thick, and are provided with tips 4 inches broad and ¼ inch thick. These latter serve a very useful purpose. They prevent the blades bending should (say) a piece of wood, iron, or any other foreign substance get among the coal by accident, and being of much thinner material they will give way before the blades themselves. The attendant examines the tips frequently, and it is only the work of a few minutes to substitute a new one. The cost of a tip is 4d.

At the top of the charging-machine is a hopper, which holds 5 tons of coal. By means of a lever working a sliding door, the amount of coal for each charge is allowed to drop into the weighing-hopper, and at the same time the weight is registered on the dial in front of the machine. The opening of the bottom door of the weighing-hopper, by means of another lever, allows the coal to drop into a small belt conveyor, whence it is automatically fed into the machine itself. This feed conveyor is driven direct from the charger, and is always proportioned to the speed of the machine. Therefore, no matter whether the coal is wet or dry, large or small, it passes on at a regular preconceived rate of flow to the machine. Owing to the 5 tons of coal which the machine carries, the total weight is naturally heavier than would have been the case had continuous bunkers been installed; and, therefore the current absorbed in continually traversing will naturally be a little more. The current consumed for charging, discharging, traversing, and hoisting to the various tiers of retorts works out at 0·63 unit per ton of coal carbonized, which at 1½d. per unit (the price we pay the Corporation) works out at 0·78d per ton of coal carbonized. Our total cost for electricity for coal and coke handling and stoking is 3·4d. per ton. This item (cost of current) could, in my opinion, be considerably improved by the use of a gas-engine and dynamo, and generating the current ourselves, as the price of gas would then only be 1s. 6d. per 1000 cubic feet; being the cost of production into our holders.

The charger is driven by a variable-speed shunt-wound motor, having a three to one range of speed. This will drive the machines at any speed at will, from 32 to 96 revolutions per minute. These speeds are found ample to deal with any coal, from 3½-inch cube downwards. The whole of these speeds are obtained by means of the controller. To charge a retort, the stoker moves his controller handle to the speed required, and admits coal by opening the outlet from the weighing-hopper, after having weighed the charge. As the coal passes into the retort, he gradually brings the handle back, and so reduces the speed. The operation is quite simple, and any weight of coal (from 5 to 8 cwt.) can be put in a 20-feet retort, so that a heavier or lighter charge can be worked according to the heats on the bench. There is a separate 8 H.P. motor, of the same type as that previously mentioned, for traversing and hoisting the machine.

The discharging-machine (Dempster and Ordish's patent) is of the telescopic ram type; and, I might say, it is entirely new and novel, inasmuch as the ram is actuated by means of wire ropes,

by which the tubes advance and recede in arithmetical progression. This allows the inner or small diameter ram to have the maximum support in its neighbour until the coke is discharged. The main object of the makers is, I believe, to couple the points of merit of a hydraulic ram with the facilities offered by the application of the arrangement of wire ropes. By the means they adopt, the cooling effect of the water is retained, while the difficulty found with the hydraulic machine, due to pressure in keeping tight packings in the hot retort, is entirely avoided. The machine consists of a framing fitted with steel travelling wheels for running on the same rails as the charging-machine, and is fitted with a separate motor and drum for actuating it, which are independent of the ram gear. On the four verticals forming the frame are cast-steel racks, engaged by pinions carried from the rising and falling frame, on which are also carried the motor and gearing for actuating the ram. The ram itself, as before mentioned, consists of a solid shaft, 2¾ inches in diameter, and a tube, fitted with a water-box (the tube and box being completely filled with water), also two carriages and wheels for running in the channels forming the frame of the ram.

The arrangement of the ropes for actuating the ram (supposing this to be closed) is as follows: The centre rope upon the ram is attached to the back end of the solid shaft, then brought over the centre wheel in the water-box, and the other end secured to the rising and falling frame. The second rope, for extending the ram, has one end fixed in the front casing of the large tube, then goes round the small wheel at the back end of the solid first length, then round the small pulleys in the casing in front of the large tube, back over the side wheel in the water-box, and finally to the large winding-drum. The other two ropes, which are for closing and pulling the ram back, are secured to one of the carriages on the large tubes and the wheels on the back end of the ram framing, and then on to the small winding-drums. When the rams start to open or extend, the rope on the large drum is wound in, and at the same time the two pulling-back ropes unwind off the drum; the first-mentioned rope only acting as a ratio or check rope in order to prevent the shaft or inner ram being travelled independently of the large tube. The ratio of the drums, I might mention, is 3 : 1—the large drum is 18 inches, and the two small drums for pulling back the ropes are 6 inches in diameter.

The motor for working the drums, also for lowering and raising the rams to the various tiers of retorts, is a series-wound motor with electric brake; and the whole of the motions, except for the travelling of the machine, are derived from the one reversing controller, which is fixed on the underside, at the back end of the frame of the ram. To prevent any liability of the attendant not stopping the ram at the end of its back or forward stroke, the controller is fitted with a spur pinion actuated by a rack on a sliding bar; the bar being traversed backwards and forwards by a striker fixed on the ram. Thus, at the end of each backward and forward stroke, the electric controller is put to the off position, locking it from being started in the wrong direction. The water-tank on the main frame is for spraying the ram and head after each discharge. The time occupied in the actual discharging of a 20-feet retort is less than half-a-minute.

Some of the principal features of this ram type I consider are: Lightness on the retorts, a water-filled ram without pressure, and general quietness and smoothness in working; the machine being practically noiseless except for the hum of the motor. With regard to a few advantages of the ram type of discharger, I am not able to give much that is new, as it has been well discussed and found proved by many engineers. The point of merit in the pusher type of the machine over others is that it allows of all coal being dealt with on the one side of the stack. This must be taken in conjunction with the projector charger, which, as previously explained, performs all the coal handling on the machine side, and allows of the most efficient subdivision of labour—thus tending to economy in working. At the same time the gritty coke dust is kept on the opposite side of the retort-bench, and away from the machinery, the motors, &c. Another advantage of the pusher type of machine is that there is no breaking-up of the coke; and with our coal in Scotland this is a very desirable feature. Dust is the chief enemy to the retort-house where so much electrical power is in use; and though the motors on all our machines are of the totally enclosed type, it has been found that the covers have not been sufficiently tight to keep out the very fine dust flying about. This has caused short-circuiting in the motors, and consequently trouble in working. We are, however, having special catches fitted on these covers, to permanently press them against the main framing of the motor; and this will, we hope, get over the difficulty. But for the stoking machinery our experience has proved electricity an extremely handy power.

At present we have eight stokers per shift, at 5s. per shift, in the retort-house, and these can produce, on an average, a million cubic feet of gas per 24 hours. They are distributed as follows: On the stoking-machine side of the retort-house, one man on the charging-machine, one on the discharging-machine, two lid men and pipe-jumpers, &c. On the coke-conveyor side, two lid men and pipe-jumpers, coke-conveyor attendants, and two producer cleaners, who also assist the other two.

[The paper was illustrated by diagrams.]

Discussion.

Mr. J. Dickson (Kelty) said he had not seen the Falkirk plant at work; but, after all, the results were the main thing to be looked to. Mr. Rule had given them some figures as to stoking and wages. So far as he (Mr. Dickson) could make out, the output amounted to about 41,000 cubic feet per man. He did not know what the make of gas per ton of coal was in Falkirk; but if they took, as an average, 9500 cubic feet, it would be about 105 tons of coal handled by the plant per day. This would come to 13·71d. per ton, which was a very good result. But he should like to know if this included everything—from the coal-waggon to the coke-bing, and whether it was the very best result to be obtained, being the winter result. Had they any idea yet as to how it would turn out in the summer?

Mr. Rule said he had not the exact figures with him; but those given did not include the whole cost from coal-waggon to coke-heap, only the cost in the retort-house.

Mr. J. W. Lill (Edinburgh) asked if it was found that the wire ropes wore well on the small pulleys, and also if the discharging shoot wore the bottom of the retorts.

Mr. J. Simpson (Inverkeithing) enquired if the men controlled the charging-machine so that no coal was thrown out at the far end of the retort.

Mr. J. R. Moyes (Edinburgh) asked if there had been any trouble in the matter of the renewal of the ropes.

The President expressed regret that members who were accustomed to stoking machinery had not taken the opportunity of discussing Mr. Rule's most interesting paper. What he had brought before them had proved very instructive; and while the paper might appeal to some more than to others, there was much in it that would be helpful to all. There were, perhaps, some things they would like to have heard more about—such as the saving effected by means of the machinery, and also whether it had affected the make of gas per ton. Those who were at the meeting of the North British Association last year would probably remember that Mr. Napier, of Alloa, said that the make per ton had increased since the introduction of the De Brouwer machine there. He would also like to know something as to the wear and tear of the retorts in connection with the sliding out and in of the discharger. He did not suppose that Mr. Rule would be in a position to tell them much as to the wear and tear of the machines, or about their upkeep. Time alone would do that. Those of them who had seen the machinery at work could not but admit that the coal was placed in a perfectly even layer throughout the whole length of the retort, and that the operator had the machine under entire control; also that the discharging-machine was perfect in its motion. One thing which much appealed to him was that the machinery for charging and discharging was on one side of the bench, while the hot-coke conveyor was on the other. This should certainly prove advantageous to the men. He thought, with Mr. Rule, that the cost of electricity could be considerably reduced by the introduction of a gas-engine and dynamo.

Mr. Rule, replying to the questions, said the eight stokers they had were in the retort-house alone. They had nothing to attend to but the 72 retorts. He might say the machines were not yet out of the guarantee of the makers; but so far as any wear and tear was concerned, there had been an alteration in connection with the ropes. They were now so arranged that the work each rope had to do was much better spread. Before, they had one rope drawing out the ram, and the other pulling it back again. Now, however, the duty of each rope was practically the same; and the result had been that the ropes did not show the slightest sign of wear. Nor did the retorts show any sign of wear through the ram. As a matter of fact, there was very little weight on the floor of the retort; and when the solid ram was out, it could be easily lifted. At the far end of the retort, before they charged, the stoker put in a stop, which prevented the coal being thrown out; then, when the charge was completed, the stop was taken out, and the coal lay at an angle at the end. Their make of gas per ton was 9400 cubic feet. They used no cannel or shale, but only splint and nuts. In the old works last year, their make per ton was 9250 cubic feet; but he had extended the length of time of the charge, and for the past week he had been getting 9700 cubic feet per ton. In the old place the work was of a different nature, and it would be difficult to say what the difference now was, as the stokers were not paid for unloading and breaking coal and taking the coke into the yard. There were separate men for attending to this. He was very pleased that the points which had been raised had been brought up, and he hoped he had answered them satisfactorily. He was sorry that circumstances had prevented him from going more fully into the subject.

Mr. J. T. Wight (Edinburgh) then delivered a lecture on

SUCTION GAS-PRODUCERS.

He explained, at the outset, that his lecture was not intended to be comprehensive, but merely to give a brief outline of the general principles involved in the construction and working of various suction gas-producers in use at the present day. These plants were, he said, regarded differently by different individuals—the power user looking at them from the £ *s. d.* point of view, and the gas engineer considering them in the light of a challenge from the engineering profession to go one better.

Before dealing with the different types of suction gas-producers now on the market, the lecturer considered briefly how the gas-engine and producer plant compared with the steam-engine in the matter of prime cost and consequent upkeep. Even in the matter of floor space, the advantage was, he said, very much in favour of the gas-engine—in fact, it required only about half the area needed by the steam-engine; so that at the outset they

had a considerable saving in ground and rental. Looking at the prime cost of the plants, the steam-engine, with boiler, piping, condenser, &c., would cost £1400, while the gas-engine and producer would involve an expenditure of £1410. But, including the cost of the necessary buildings, foundations, and settings, there was a sum of about £300 in favour of the gas-engine, even on a comparatively small unit. Without considering all the details, it could be seen at once that there would be an annual saving of £350 in favour of the gas-engine; or, all things considered, while the steam-engine cost ½d. per B.H.P. hour, the gas-engine would give the same for half the amount. The steam-engine only used 12 per cent. of the total fuel supplied to it, while the gas-engine used 20 per cent. He thought the arrangements which could give results such as these were well worthy of, at least, some little consideration by them.

The lecturer went on to say that as the operation of a suction gas-producer depends entirely on the working of the gas-engine, it might be advantageous to study what was going on in the gas-engine cylinder. The "Otto," or four-cycle engine was the one most frequently used. The term "four-cycle" had its origin in the method on which the engine worked. The complete cycle of operations might be divided into four distinct periods. The first stroke was called the suction or charging stroke; and during this period both gas and air valves were open, and consequently an explosive mixture of gas and air was drawn in behind the piston. On the return stroke, both valves were closed, and the mixture was compressed—its pressure rising. At the end of this stroke, which was called the "compression stroke," a timing-valve was opened, and the charge was put in communication with the hot tube, when an explosion took place, and the piston sped forward on its working stroke. On the return stroke, the exhaust was opened, and the products of combustion were swept out. It was this stroke that was the important one for a proper working of the suction producer, which, as its name implied, was operated by suction, provided for by the engine itself. All gas engineers must be aware that this producer had been evolved from the pressure gas-producer invented by Mr. J. Emerson Dowson in 1878. This invention was specially valuable on account of the impetus it gave to the evolution of the gas-engine in large units, resulting from the possibility of obtaining power gas cheaply. It had been gradually improved until to-day the engineer was able to offer the power user a plant, the trials and results of which seemed to augur well for its general introduction in the near future, even for quite small powers.

The lecturer then proceeded to narrate the history of invention in connection with suction gas-producers—giving detailed descriptions, illustrated by diagrams shown on the screen, of the Campbell, Crossley, Daniels, Dowson, Paxman, Pierson, Tangye, and the Industrial, Loncauchez, Paywell, and Winterthur producers—and then went on to say that the following results had been ascertained: In Dublin, an 18 H.P. electric light engine, with suction-gas plant, working 11 to 12 hours per day, used in this time 84 lbs. of coal. This worked out at 1s. 1d. per 12 hours' run. With town gas at 3s. 8d. per 1000 cubic feet, it cost 6s. 6d. for this run. In Adelaide, on town gas, running 24 hours per day, the cost was about £25 per month. An engine (a 35 H.P. one) and producer, guaranteed not to exceed £25 per month, cost but £9 per month—only a seventh the cost of town gas. He was, however, inclined to doubt this figure—probably it was only the cost of fuel. Taking it at £18, town gas still cost 3½ times more than suction gas. In Huddersfield, an engine ran for nine months on town gas at 2s. 7½d. per 1000 cubic feet; and on producer gas the cost was only one-fourth. The labour per day for starting and stoking occupied only about one hour. In Liverpool, a 40 H.P. engine ran for 34 hours on town gas at a cost of £2 15s.; and on producer gas it went for 74 hours for £1 6s. 4d. This worked out at 1s. 7½d., as against 4½d. per horse power. A firm of brewers in Suffolk had a 10 H.P. engine, running eight hours per day and consuming in this period 56 lbs. of anthracite at 20s. per ton, and it cost 6d. per day. A London firm had an 18 H.P. engine, the cost of which was 6s. per week, compared with 28s. for the same power with town gas. Generally, anthracite coal, costing 20s. per ton, on a 20 H.P. engine, worked out at 2s. 4d. per hour; whereas coal gas, at 2s. per 1000 cubic feet (550 B.Th.U.), using 17 cubic feet per hour, came to 8·16d. per hour. Consequently, they had 6d. per hour saved on a 20 H.P. engine.

[The lecture was illustrated by lantern slides.]

The PRESIDENT said he was sure the members had all listened with the greatest pleasure to the lecture. Suction gas-producers were seriously engaging the attention of gas engineers and managers all over the British Isles; and he thought he was safe in saying that the gas profession were, generally speaking, finding in suction gas a more formidable rival than electricity. They were convinced that the price of gas would have to be very much lowered if they were to retain manufacturers as customers for power. It was evident, however, that suction gas could not, as yet, touch the small consumers—consumers who only required to use a gas-engine for an hour or two a day. Moreover, gas undertakings had a large field before them in the supply of gas for cookers and fires. At the same time, the sooner they reduced the price of gas, the better it would be for them. The lecture had been a very instructive one, and had shown them how the different plants worked. He proposed a hearty vote of thanks to Mr. Wight, and also to Mr. Rule for his paper.

Mr. WIGHT and Mr. RULE having tendered their acknowledgments, the proceedings terminated.

ENGLISH GAS COAL IN HOLLAND.

A recent issue of the "Journal für Gasbeleuchtung" contains an article upon the properties of English gas coals and the quantities that are consumed in Holland; the material being compared in both respects with the coals that are imported from Germany. The information given is obtained from particulars that were supplied by Mr. C. T. Salomons, of Rotterdam, a member of the Purchasing Committee of the Association of Dutch Coal Gas Manufacturers.

The total amount of coal imported into Holland during 1905 from Great Britain and Germany was 6,381,000 metric tons; 1,949,000 tons, or 30·5 per cent. coming from this country. The total amount of gas coal imported in the same year was 816,518 metric tons, of which 525,194 tons were Westphalian and 291,324 tons, or 35·7 per cent., was British. The British total was made up of 242,186 metric tons of Durham coal, 44,287 tons of Yorkshire, 3955 tons of Scotch (United Gas Coals), and 896 tons of unknown origin. Durham coal was carbonized in 170 different works; Mickley coal was carbonized to the extent of 75,367 tons in 43 works; Wearmouth coal to the extent of 46,609 tons in 15 works; New Pelton Main to the extent of 28,317 tons in 27 works; and Londonderry coal to the extent of 22,960 tons in 12 works. Nineteen other varieties of Durham coals were also carbonized in amounts of from 100 to 14,500 metric tons. Yorkshire and Derbyshire coals were carbonized in 45 works; the chief variety consumed being Thorncliffe Silkstone nuts, of which 17,741 metric tons were carbonized in 19 works. Thirteen other descriptions were carbonized in amounts up to 5400 tons.

All the large, and most of the small, gas-works in Holland are so situated that coal can be delivered to them either per ship or per rail; but they naturally find it more convenient to receive their coal in small daily trainloads than in occasional heavy shiploads. In the year 1905, the gas-works at Amsterdam, Rotterdam, The Hague, and Utrecht consumed altogether 407,444 metric tons of coal, 77,382 tons of which, or 19 per cent., was English. The proportion of English coal carbonized at Amsterdam itself is higher than the figure mentioned; for 60,000 metric tons of Londonderry coal were in 1905 consumed there alone. In the smaller gas-works of Holland, roughly equal quantities of English and Westphalian coals are employed.

The article from which we are abstracting goes on to state that English gas coals are cleaner than Westphalian coal, containing less dross. Most Durham coals measure between 42·3 and 43·4 cubic feet per long ton; but Mickley coal measures 44·9 cubic feet. Yorkshire gas coals run lighter—*e.g.*, Thorncliffe Silkstone nuts measure 44·9 to 46·1 cubic feet. As a rule, English gas coals require a longer carbonization at a lower temperature than Westphalian coal. Charges of Westphalian coal are usually worked off in 4 or 5 hours; but similar charges of English coal require 5 or 6 hours for carbonization. The higher temperature at which the English coals are carbonized tends to produce stoppages in the ascension pipes, to thicken the tar, and to encourage the formation of naphthalene; but Mickley, Silkstone, and Wigan coals are free from these defects. The coke of English gas coal is usually harder to break, denser, and larger in size than Westphalian coke; but Mickley coke and that of Yorkshire coal runs smaller and softer. Durham coke, especially that from the New Pelton Main and the Axwell Garesfield coals, has a high calorific value. English coke yields less clinker than Westphalian coke; but it is more trouble to remove from the bars of a furnace. The volume of gas made per ton of English coal is practically identical with that made from Westphalian coal; 10,050 cubic feet and upwards being easily and regularly obtained per long ton. The illuminating power of the gas is also practically the same—*i.e.*, 15-candle power; but the gas from English coal contains more sulphur.

The manufacture of water gas is growing rapidly in Holland, and in many places English coke is preferred to German for its preparation, in spite of the greater difficulty in clinkering the producers. Carburetted water gas is made in 14 Dutch works: Amsterdam (east factory), Rotterdam, The Hague, Utrecht, Leiden, Leeuwarden, Zwolle, Deventer, Tilburg, Maastricht, Alkmaar, Haarlem, Enschede, and Bergen op Zoom. Plant for the preparation of blue water gas is to be erected in five places: Amsterdam (west works), Venlo, Zevenbergen, Arnheim, and Zutphen.

A favourite and typical Durham gas coal used in Holland is Axwell Garesfield. It measures about 42·7 cubic feet per long ton; and on the large scale gives from 10,660 to 10,950 cubic feet of gas per ton, having an illuminating power of 12·3 candles, a specific gravity of 0·367, and a calorific value of 472 B.Th.U. per cubic foot. After purification, the gas contains 18·25 grains of sulphur per 100 cubic feet. The coke measures 80 cubic feet per ton, has a high calorific power, and contains but little clinker. A typical Yorkshire gas coal imported into Holland is Pope's Diamond coal. It measures about 44·5 cubic feet per long ton; and gives on carbonization 10,600 cubic feet of gas, having an illuminating power of 14·6 candles, a specific gravity of 0·394, and a calorific value of 600 B.Th.U. per cubic foot. The purified gas contains 18·15 grains of sulphur per 100 cubic feet. The coke is small and readily combustible; but it is not so well suited as are other varieties to the manufacture of water gas. The clinker in it is small in amount and brittle.

It is said in Holland that Yorkshire coal tends to vary in quality, even when coming from the same pit; but this accusation cannot be brought against Thorncliffe Silkstone nuts. At present Yorkshire provides 15 per cent. of the English coal imported; but the proportion is rising, owing to the lower price. Lancashire coal is also being studied; but it is handicapped by the more expensive voyage from the west coast of England.

The price of first-quality Durham coal has risen steadily since the beginning of 1905 from 8·46 marks to 10·84 marks per metric ton f.o.b. Tyne; and that of the second quality from 8·17 marks to 9·78 marks. To these prices must be added the late 1s. tax, the freight of 3s. 10½d. to Amsterdam or Rotterdam, and the cost of transference into barges—viz., 2d. Hence the prices of Durham coal in Amsterdam last September were 15·95 marks and 14·90 marks per metric ton. The price at the pits of best screened Yorkshire gas coal remained steady during 1906 at 8·40 marks, and that of unscreened gas coal at 6·90 marks; both figures being about 0·50 mark higher than in the previous year. The cost of conveying Yorkshire coal from the pit's mouth to a barge at Amsterdam or Rotterdam is 7·65 marks per ton; hence best screened Yorkshire gas coals were quoted last autumn in those cities at 16·05 marks, and unscreened Yorkshire gas coals at 14·55 marks per metric ton. Large quantities of Yorkshire gas coal have been exported lately to France.

POSITION OF GAS MANUFACTURE IN RELATION TO COKE-OVENS.

A recent issue of the "Journal für Gasbeleuchtung" contains an article by Herr F. Schreiber, of Waldenburg, Silesia, in which the author compares the phenomena of coal carbonization that occur in the gas-retort and the coke-oven respectively, and finally devotes some attention to the question of carbonizing limed coal briquettes.

Vertical Retorts and Coke-Ovens.

Herr Schreiber begins his article by remarking that the relative merits of horizontal and vertical retorts have already been frequently discussed, but that there are three points in favour of the vertical retort—viz., the higher yields of tar and ammonia and the production of a larger and more coherent coke—to which further attention may be advantageously devoted. As Hilgenstock and others have already stated, the higher yields of tar and ammonia in the vertical retort are due to the more favourable conditions in which the gas passes away from the mass of fuel, without coming so much into contact with the heated walls of the distilling vessel. With its rectangular cross-section, the vertical gas-retort much resembles a small vertical coke-oven, with the exception that the latter is built of separate pieces of fire-brick, whereas the retort is composed of one continuous piece.

The gases and tar vapours evolved from coal exhibit a greater tendency to decompose as their temperature rises, as they are brought into more immediate contact with the heated walls of the carbonizing vessel, and as they remain a longer period within it. Hence there is a better yield of tar and of ammonia in Bueb's vertical retort than in a horizontal coke-oven. In a horizontal coke-oven, conditions can be improved by providing facilities for the rapid escape of the gases; and therefore it is better to fit such an oven with two ascension pipes arranged centrally about the two halves of the chamber and communicating (as may be preferred) with either one or two hydraulic mains. The author has found on a large scale, by fitting a coke-oven with a second ascension pipe which formerly had one only, that the yield of ammonia from the same variety of coal, calculated as sulphate, was increased by 0·15 per cent.—a gain that quickly neutralized the extra expense involved in constructing the apparatus.

In the conditions of modern coke-oven practice, it is scarcely conceivable that coke-ovens can be built vertically. Per unit of coal capacity the cost of erecting a vertical oven is much greater than that of building a horizontal one, because a vertical oven can only be heated economically when of comparatively small size; while, moreover, when any repairs are requisite, the whole battery of twelve vertical ovens must be thrown out of action. The heating of the horizontal flues round a vertical oven is also less efficient than the heating of the vertical flues round a horizontal oven. In the latter case the natural asceusional force of the gas renders it easy to keep the interior of the horizontal oven at approximately atmospheric pressure; but in the case of horizontal flues, a partial vacuum must always prevail within the vertical oven, which may cause loss of volatile products through leakage. Vertical ovens have the advantage of giving a denser coke; but much greater density still can easily be obtained by the use of compressed coal. The objections that have been urged against the vertical coke oven apply with still greater force to the vertical retort.

The amount of coal that can be carbonized per unit of heated surface of retort is the same as per unit of heated surface of coke-oven—being, in fact, 1·54 lbs. per square foot per hour. But the amount of coal that can be carbonized per unit capacity is twice as great—(*e.g.*, 37·4 lbs. per cubic foot per hour)—in a retort as in a coke-oven. Since per unit capacity there is a greater available heating surface in a retort than in an oven, the carbonization is more thorough and more rapid. This causes the yields of gas and of volatile products to be greater; but, on the other hand, it reduces the yield of coke and impairs its good qualities. Inasmuch as gas is the most important product of a gas-works, what has been already said shows that the retort is the proper apparatus to employ there. From the aspect of obtaining economical and uniform heating of the coke, a retort built in the form of a horizontal coke-oven with vertical flues appears to be the ideal form of carbonizing vessel; but mechanical difficulties prevent a retort being constructed in this manner, and therefore a vertical gas-retort having a cross-sectional area like that of a coke-oven is the best form of apparatus.

The coke made from gas coal in a vertical retort occurs in larger pieces, and is harder than gas coke made in the usual manner. But the yield of really hard coke fit for employment in metallurgy must always be much smaller than that of a coke-oven. Inasmuch as gas-makers lay stress on obtaining a high gas yield, they are compelled to employ a caking coal, which inevitably leaves a porous coke of low specific gravity. A good metallurgical coke can be obtained from caking gas coals by compressing them into blocks in the presence of moisture. In this manner the particles of coal are much more firmly agglomerated than by the natural pressure of a loose column of coal 13 feet high, such as exists in a vertical retort. Moreover, in order to obtain a large coherent coke from caking gas coal, the process of carbonization must be carried out more slowly than is customary on a gas-works. Moisture in the coal is advantageous in this respect, because the high latent heat of water vapour causes the damp coal to rise in temperature slowly, and the gas to be driven off less rapidly than would otherwise be the case. In coke-oven practice, a hard coke is best obtained by carbonizing a coal containing at least 12 per cent. of moisture—a method of working wholly unsuitable to the manufacture of gas. A coke-oven is usually erected close to the coal pit, and can therefore use a cheap coal containing dust. A gas-works must be situated close to its consumers, and must therefore purchase a screened coal free from fine particles, lest it lose gas during storage.

Gas can be made in a coke-oven resembling retort gas, though the oven walls are generally more or less leaky. The mean composition of coke-oven gas is somewhat as follows: Air, 6·20 per cent.; nitrogen, 16·10 per cent.; carbon dioxide, 4·20 per cent.; hydrogen, 42·03 per cent.; methane, 21·86 per cent.; heavy hydrocarbons, 3·10 per cent.; carbon monoxide, 6·50 per cent. This gas has a heating value of 411 B.Th.U. per cubic foot. Still, it does not follow that a coke-oven can continuously produce a gas of equal value to that made in a retort. The retort is fired with coke because the gas is more valuable; the coke-oven is fired with gas because coke is its most valuable product. If, however, arrangements are made to collect the gas evolved in an oven in two separate portions, the first (amounting perhaps to as much as 50 per cent. of the total), which is better in quality, can be sold, while the second portion, of poorer gas, will be sufficient to fire the ovens. Schniewind gives the composition of the oven gas evolved during the first carbonization period in the plant of the New England Gas and Coke Company, at Everett, U.S.A., as follows: Oxygen, 0·1 per cent.; nitrogen, 4·1 per cent.; carbon dioxide, 2·9 per cent.; hydrogen, 44·4 per cent.; methane, 37·4 per cent.; heavy hydrocarbons, 5 per cent.; and carbon monoxide, 6·2 per cent.—the calorific value being 606 B.Th.U. per cubic foot.

The coal carbonized in the coke-ovens of Lower Silesia yields in its air-dried state the following products: Coke, 72·72 per cent. (containing 6 per cent. of ash); and volatile matter, 27·28 per cent. The yield of tar is 3·77 per cent.; ammoniacal liquor, 6·75 per cent.; benzene, 0·881 per cent.; sulphuretted hydrogen, 0·285 per cent.; carbon dioxide, 1·425 per cent. The make of gas is equal to 11,100 cubic feet per long ton of dry coal, and, free from ash, contains nitrogen, 3·87 per cent.; carbon dioxide, 3·30 per cent.; hydrogen, 52·15 per cent.; methane, 30·27 per cent.; heavy hydrocarbons, 4·88 per cent.; carbon monoxide, 8·53 per cent.—its calorific value being 550 B.Th.U. per cubic foot. In terms of ammonium sulphate, the yield of volatile ammonia is 0·937 per cent.; and of non-volatile ammonia, 0·054 per cent.

Carbonization of Limed Briquettes.

The idea of compressing small coal into briquettes under a pressure of 200 atmospheres, with the object of obtaining a harder and more coherent coke than is otherwise possible from a gas coal, renders it feasible to resuscitate the old plan of treating the coal with lime in order to retain the sulphur. It will be remembered that the Cooper coal-liming process was unsuccessful owing to the impossibility of mixing the lime uniformly with lump coal, and owing to the harm done by the lime dust to the eyes of the stokers when drawing the retorts. If coal, however, is to be carbonized in a state of powder, it can, of course, without any trouble, be mixed with a suitable proportion of lime—viz., with (according to the sulphur present) from 3·5 to 4 per cent. Experiments have been carried out on a large scale with the carbonization of a particular variety of compressed powdered coal before and after the addition of 3·5 per cent. of lime; the results being shown in the table, p. 224.

The figures prove that the yield of coke is increased, and also the proportion of sulphur in it; but the extra lime in the coke is not harmful in any steam-raising or metallurgical furnace where it is employed. It will also be seen that the amount of sulphur calculated as sulphuretted hydrogen in the crude gas is decreased by 81 per cent., and the proportion of sulphur, as such, in the

	Before Liming.	After Liming.
Ash of coal, per cent.	5·24	8·74
Coke: yield ,,	68·56	69·77
,, ash ,,	7·40	12·60
,, sulphur ,,	1·03	1·36
,, large Calories per kilo.	7,610	7,279
,, B.Th.U. per lb.	13,700	13,100
Gas: yield per long ton (c. ft.)	11,500	12,200
,, B.Th.U. per cub. ft.	545	539
,, illuminating power (argand)	12·5	11·80
,, ,, ,, (flat-flame)	7·9	7·17
Sulphur in crude gas as H_2S (grains per 100 c. ft.)	195·5	37·2
,, purified gas as sulphur ,, ,,	27·2	7·2
Ammonia as sulphate, per cent.	0·839	1·05
Cyanogen as K_4FeCy_6 (grains per 100 c. ft.)	120·4	88·1
Tar, per cent.	6·6	5·8

purified gas by 73·5 per cent. through the use of lime. The make of gas is somewhat increased. Its illuminating power (quoted in the above table in terms of Hefners at the 150 litre rate) is a trifle reduced. The yield of ammonia is increased by about 25 per cent.; while that of the cyanogen in the gas calculated upon the coal is reduced by about 22 per cent.

In conclusion, the author remarks that the introduction of the Bueb vertical retort brings a coal-gas works a step nearer to a coke-oven factory, but that the two can never become identical in their methods of working, as their aims are different. A really hard coke can be obtained from a coal rich in gas if it is first washed, powdered, and made into briquettes; and the incorporation of a suitable proportion of lime with the coal-dust will have the advantage of giving a larger amount of ammonia, and a better quality of gas which requires less expensive purification than is usually necessary.

THE NEW WATER SUPPLY FOR NEW YORK.

Progress of the Cross River Dam.

There is at present under construction in the Croton watershed near Katonah, New York, a large dam designed to impound about 9 billion gallons of water for an additional supply to be delivered to the city through the new Croton aqueduct. The reservoir will be 3 miles long, and will have a maximum depth of over 100 feet. The dam crosses the valley of the Cross River nearly at right angles to it, with a total length and height of about 900 feet and 170 feet respectively. The south end of the masonry dam terminates in an earth dam oblique to its axis, with a masonry core wall; and the north end, at a corresponding concrete overflow. The maximum cross-section is about 115 feet wide at the base, above which both upstream and downstream faces are battered to a height of about 45 feet. Above this point the upstream face is vertical, and the batter of the downstream face changes from 0·75 : 1 to 0·56 : 1, which continues to a point 50 feet below the top, where it is tangent to a curve of 96 feet radius tangent to the vertical under the coping, where the thickness of the dam is 23 feet. Its foundations are carried down to solid rock at a maximum distance of about 40 feet below the original low-water level of the river. The structure is built of cyclopean masonry faced with concrete blocks of large dimensions corresponding to ashlar masonry. The principal quantities involved in its construction include about 117,000 cubic yards of excavation and 155,000 cubic yards of cyclopean and block masonry.

The importance of putting this reservoir in service at the earliest possible date, so as to hasten the availability of additional water supply in case of threatened water famine, was so urgent, that its construction was deemed a work of emergency. The Aqueduct Commission, in awarding the contract, took into consideration not only the experience and ability for successfully conducting work of this character of the seven competing firms, but also the available plant controlled by each ready to be immediately installed. In consideration of the large amount of suitable plant available and the skill and experience on this class of work, the contract was awarded to one of the highest bidders at a price of $1,246,211. Operations were begun in the latter part of June, 1905; but shortly afterwards work was practically stopped by an injunction. This, however, was removed late in November, and the Contractors began at once to reorganize their force which had become dispersed. Work was started with vigour, and has continued since without interruption. An account of the progress made appeared in a recent number of "Engineering Record," from which the following particulars are taken.

The Contractors diverted the water from the site by means of two earth and rock-filled temporary dams across the valley above and below the permanent dam. These were connected by a wooden flume large enough to carry the ordinary floods of the river over the excavation, and were provided with two 5 feet steel pipes, 90 feet long, supported on steel columns across the axis of the dam. A standard gauge railroad track, 1½ miles long, was built to connect the site with the New York and Harlem Railway tracks, and provide for the delivery of plant and materials. The power plant, with about 1000 H.P. boiler capacity and air-compressors rated at 1120 H.P., was established in the valley south of the dam, and on the hill near the south end of the dam there was also installed a machine and repair shop, a concrete mixing tower and plant, and a yard for casting the concrete blocks. One 18-ton and two 15-ton cableways, all of about 1300 feet span, were installed parallel with the axis of the dam, on moveable towers, enabling them to command the entire area of the work. Two additional cableways with fixed towers were temporarily installed at right angles to these, and a number of derricks were erected to serve the concrete plant, the quarry, and the excavation. The large and complicated plant installed has been supplemented by a very complete machine and repair shop, which has afforded immediate relief in cases of accidents.

The excavation for the foundation of the dam was practically completed for a length of 500 feet in June last year. Little difficulty was encountered with water, most of it being due to surface drainage, which was removed by two steam-pumps with 6-inch suction-pipes and three smaller ones. They were operated only half the time, and had an average lift of about 20 feet. When springs were encountered, masonry walls were built round them, and two temporary 1½-inch wrought-iron vent pipes were connected to them to afford some means of controlling them. The work of laying cyclopean masonry is done by gangs of nine men for each derrick; two being masons, six labourers, and one foreman. The masonry materials are handled by three cableways and twelve stiff-leg derricks in zig-zag rows on the opposite side of the dam. Four of them have 60-feet and eight 54-feet booms—all being operated by engines worked with compressed air. The arrangement of the derricks on both sides of the dam leaves the entire surface of the masonry unobstructed, and provides for maximum rapidity of construction. Two of the cableways are normally used to furnish concrete to the derrick gangs on the upstream and downstream faces of the work. They deliver it in regular rotation from one end of the dam to the other, then return to the beginning, and so on. The third cableway usually delivers stone to the crusher. The best record for a day's work is 245 two-yard buckets of concrete, 12 buckets of mortar, and some stone, handled by two cableways in ten hours.

After the masonry was commenced, it was found that the maximum requirements of power for the derricks, in addition to all the other plant in simultaneous operation, though not beyond its capacity, was too great for the economical working of the central power plant; and three independent 100 H.P. horizontal boilers were installed to furnish steam for the 250 H.P. engine which runs the mixing plant and rock crusher. About 86,500 cubic yards, or a little more than one-half of the total amount, of masonry has been laid since June 1, 1906; care being taken to keep the upper surface within 2 or 3 feet of a horizontal plane which is now more than 50 feet above the bed of the river. The concrete face-blocks are built up one course in advance of the cyclopean masonry, and are laid in 1 : 1 portland cement mortar mixed by hand in steel skips located wherever required on the dam. The blocks are cast at least three months before they are used, and are being manufactured at the rate of about 350 to 500 cubic yards per week; while some 300 to 400 cubic yards per week are built into the dam. Backing stone is quarried at the rate of about 17,500 cubic yards per month, and about the same quantity was used during the past summer. About 35 per cent. of the cyclopean masonry is backing. During last summer, the maximum amount of masonry laid per month was 18,600 cubic yards, which, considering the dimensions of the dam and the number of derricks employed, is believed to be a high record. Under present conditions, it is thought that the dam may be completed by August next. The original schedule contemplated a maximum progress of 20,000 to 25,000 cubic yards of masonry per month during the second season.

Besides the work on the main dam, a large amount of the other work required by the contract was executed during the summer. Trees were cleared from about 350 acres of the reservoir site, and two saw-mills were operated, turning out 1,500,000 feet of timber, nearly all of which has been used at the dam. The principal items of work done during the past year include 110,000 cubic yards of earth and 71,000 cubic yards of rock excavated, including quarries, 12,500 cubic yards of concrete blocks built, 6500 cubic yards of concrete blocks set in the dam, 77,000 lineal feet of boundary walls built, and 87,500 cubic yards of masonry finished in the dam. About 63 per cent. of the basis of the award has been completed. Laying masonry in the dam was commenced on the 27th of May last year.

Gaslight and Coke Company's Dividend.

We are informed by the Secretary of the Gaslight and Coke Company (Mr. Henry Rayner) that the accounts for the past half year show that—subject to audit—the balance to the credit of the net revenue account will enable the Directors to recommend the payment of a dividend at the rate of £4 8s. per cent. per annum, carrying forward a balance of £229,952 19s. 11d. to the next account. This compares with a dividend at the same rate for the latter half of 1905, and a balance of £181,298 to the good.

The New Electric Light.—It appears that the claims made for the new electric light referred to in the "JOURNAL" last week (p. 141) are being accepted in New York on the strength of Professor Parker's reputation. It seems that he and Mr. Walter Clark, an electrical engineer, have been working together at the University for seven years to find an improved means of lighting; and Professor Parker candidly admits that, more by accident than anything else, he made the discovery which resulted in the production of his lamp.

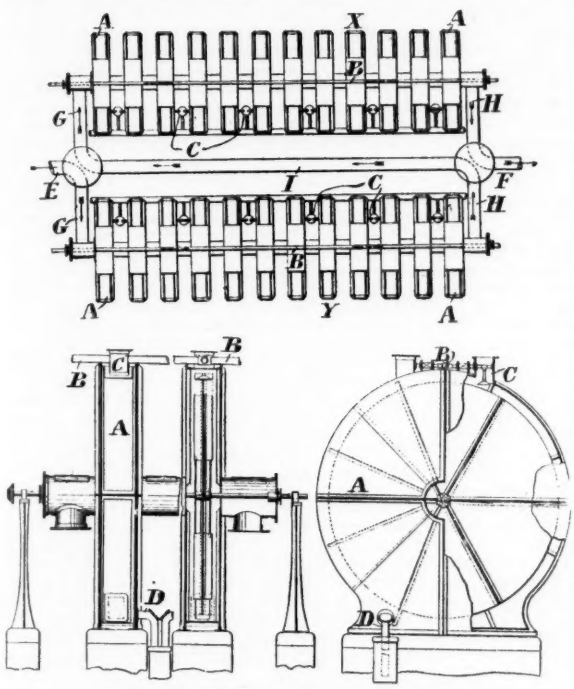
REGISTER OF PATENTS.

Condensing and Purifying Gas.

CLARK, F., of Southend.

No. 26,998 ; Dec. 27, 1905.

This apparatus, for use in the purification of gas, embodies a plurality of chambers fitted with revolving discs with means for supplying liquid, and through which chambers the gas is successively passed. Means are provided for controlling the liquid supply so that it can be cut off for a period from a number of chambers which may afterwards be supplied with liquid, while others are not then so supplied.



Clark's Rotary Condenser and Purifier.

Each chamber is in the form of a drum A ; the several drums (connected together by pipes) being constructed of sheet metal with angle iron framings. A shaft extends concentrically through each set of chambers (supported in suitable bearings) and is provided externally with bevel wheel driving gear. Within each chamber is mounted on the shaft a disc (of somewhat less diameter than the chamber) provided with radial blades connected by arms to bosses surrounding the shaft. Usually these blades are at the peripheral portions of the discs only, and are attached thereto indirectly—as by riveting to lengths of angle iron secured to the discs. Other radial blades, secured to the end walls of the chamber, are constituted by lengths of angle iron. An external water or liquor supply pipe B is connected with the interior of each chamber, and provided with a spraying device. These spreading devices are usually arranged in the upper parts of the chambers, as in the casings C. The lower part of each chamber is provided with an outlet D, for carrying away tarry and other matters—the delivery being here shown as taking place into a seal-pot.

The two sections or sets of chambers X and Y are so connected by pipes and provided with controlling means that gas flows in either direction through both, so that while passing through one set (say X) the treatment will be dry, whereas on reaching, and while passing through, the second set (say Y), the treatment will be wet. Afterwards gas can be caused to flow in the contrary direction and undergo dry treatment in the set Y in which wet treatment previously took place, and wet treatment in the section or set X in which dry treatment previously took place.

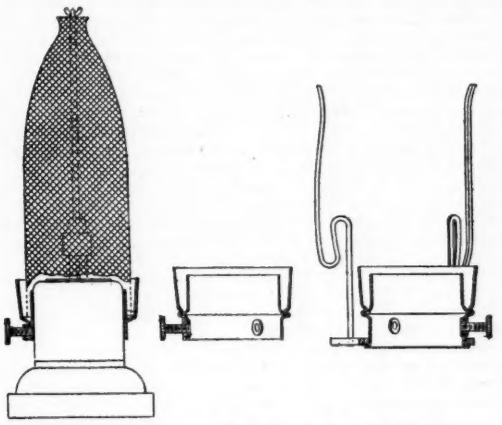
E is the inlet pipe and F the outlet pipe. G and H are pipes connecting the adjacent ends of the two sections with the gas inlet and outlet pipes respectively ; communication being controlled by two four-way valves, which also control communication between a pipe I and the ends of the two sections. With this arrangement the gas may be caused to flow through the apparatus in the direction of the arrows, first through Y and then through X, or in the reverse direction. The revolving discs, with their paddle blades, throw the gas towards the air-cooled sides of the chambers A, and it is well rubbed against the blades as they revolve—thus causing the tarry particles to be freed from the gas and thrown down to the bottom of the chambers ready for escape into the tar main or well. The " formation of naphthalene crystals between the stationary blades on the walls of each chamber will be assisted when the degree of temperature is suitable for the formation of such crystals."

Mantle Protector.

MARK DUFFIELD & SONS and J. UPTON.

No. 27,139; Dec. 29, 1905.

This is an adjustable combined protector and support for the base of an incandescent mantle, consisting of a collar having an inner and an outer rim, so as to form an annular groove near the top of the burner when the mantle is new. Within the groove rests the lower edge or base of the mantle in combination. Means are provided for holding the combined protector and support in position on the burner so as to



Duffield and Upton's Mantle Protector and Support.

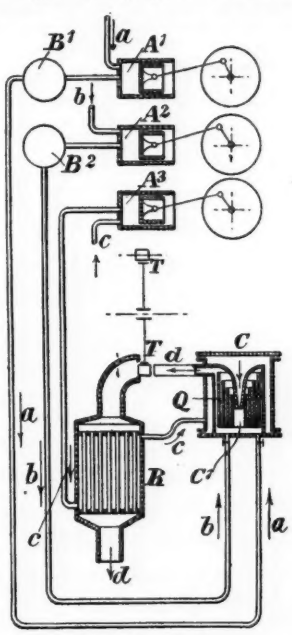
suit the length of the mantle. Thus the combined protector and support is capable of being raised to support and protect the base of the mantle as it becomes frayed or broken. The illustration shows one form of " protector " with mantle attached ; a modification of the arrangement apart from the mantle ; and a view of the protector combined with a chimney or globe support.

Gas-Turbines.

GADDA, G., of Milan, Italy.

No. 27,272 ; Dec. 30, 1905. Date claimed under International Convention, Jan 2, 1905.

According to this invention, the utilization of a portion of the heat, which in ordinary gas-engines is lost with the exhaust gases and the circulating water, is attained by a gas-turbine arranged according on the following plan : The explosion is caused to take place in a chamber into which air and a fluid are separately introduced ; and the explosion products are allowed to expand through the turbine, in communication with the explosion chamber, in which no pieces of mechanism are kept in motion, so as to admit of a higher average wall temperature than that of usual piston engine cylinders. In the explosion chamber a substance is contained, which is capable of absorbing an amount of heat, not exceeding that carried away in the usual engines by the jacket water, and of giving up the heat in a successive phase to another fluid, utilizing it " with a satisfactory efficiency." The exhaust gases escape through a heater, so that they are utilized to heat the substance which performs the supplementary cycle, as will be described.



Gadda's Gas-Turbine.

There are three pumps A_1 A_2 A_3. In the first, a fluid (either a liquor or a gas) is compressed, which is capable of burning or exploding when mixed with a quantity of air. The compressed fluid is stored in a tank B_1 acting as a receiver, with the view of rendering the supply of the turbine independent of the alternate lifting of the pump valves, and having a fluid under pressure at disposal for starting the motor. In pump A_2, the air intended for mixing with the fluid supplied by pump A_1 is drawn in, compressed, and then likewise stored in a tank B_2. The pump A_3 is intended for compressing the fluid which is to perform

the supplementary cycle. Should air be the fluid chosen for this purpose, the two pumps A_1 A_2 would, of course, be sufficient.

A chamber C contains the explosion chamber proper C^1, wherein the air and the fluid, supplied by the pump A_1, are separately introduced. Explosion or combustion under constant volume is caused to take place, whereupon the explosion products are allowed to expand through the turbine T, the first guiding apparatus of which communicates with the explosion chamber. Within the explosion or combustion chamber, a substance Q is contained, which has no effect upon the fluids surrounding it, for which the product of the specific heat by the coefficient of transmission of heat is a maximum, and which gets heated at the expense of a portion of the heat developed by the explosion or combustion products up to the maximum temperature consistent with the nature of the materials of which the chamber C is made, as well as with the nature of the substance in question itself.

There is a turbine T (of any known type); also a heater R, through which the gases, which have expanded within the turbine, are allowed to escape with the aim of heating (by means of their residual heat), at a constant volume, the fluid that has been compressed by the pump A_3 and is intended to perform the supplementary cycle.

In the drawing, the arrows A refer to the motion of the fluid which is performing the primary cycle; the arrows B refer to air; the arrows C to the fluid for the supplementary cycle; and the arrows D to the explosion or combustion products.

The two cycles succeed each other within the turbine. As soon as the explosion or combustion has taken place in the chamber C, and the pressure has become as low as that of the fluid which is to perform the supplementary cycle, the fluid (which has been heated both at a constant volume within the heater R and by its having been caused to circulate around the chamber C, thereby absorbing the heat which otherwise would have been wasted) enters the explosion chamber, where it gets heated again at the expense of the heat stored within the substance Q, which is always contained in the chamber C, and is thereafter allowed to expand within the turbine. As soon as the pressure within the explosion or combustion chamber, which also works as a regenerating chamber, has sunk so as to equal the pressure of the air and fluid respectively supplied by the tanks B_1 and B_2, they enter the chamber, mix, and are ignited in due course. The turbine is therefore alternately driven by the explosion or combustion products and by the fluid heated at the expense of the heat drawn from the combustion or explosion products. This fluid may also be utilized with the view of cooling the parts of the movable wheels of the turbine which are most subjected to heating.

Distilling Coals and Other Hydrocarbonaceous Substances.

THOMPSON, W. P.; a communication from H. WURTS, of Newark, N.J., U.S.A.

No. 753; Jan. 11, 1906.

This invention relates to the distillation of coals—particularly cannel, bituminous, and other coals having a high percentage of volatile matter—shales, lignites, and other hydrocarbonaceous substances which yield, when subjected to heat at certain temperatures, vapours of heavy oils, waxes, naphthas, phenols, and other products.

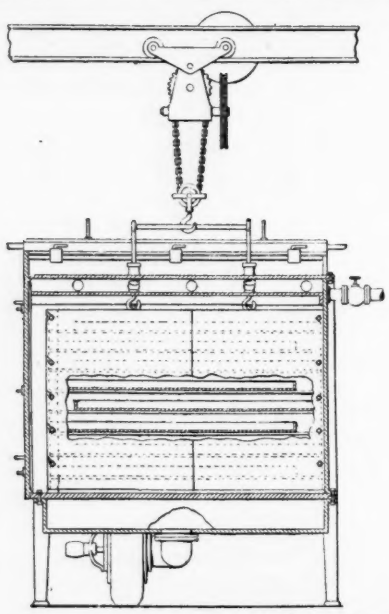
The object of the invention is: First, to obtain by the distillation of the substances the maximum amount of the products which are thrown off at the lower temperatures without dissociating the initial products or producing any, or but a minimum quantity of, gaseous products. Second, to prevent the destruction, by combustion, of the residual coke produced by the distillation of cannel and other coals. Third, to promote the rapid, continuous, uniform, and practically simultaneous distillation of the entire charge of these substances in the distilling apparatus. Fourth, to extract the volatile products of coals, shales, lignites, and other hydrocarbonaceous substances by direct contact therewith of free moving currents of the hot products of combustion or hot neutral gases, and thus effect a thorough extraction of these products from the substances and greatly reduce the time required for distilling a charge. Fifth, to ensure an uninterrupted movement of the heat currents into, through, and out of, the distilling chamber, and their intimate contact with the coal or other substances therein, so that the melting down or coking of a part of the charge will not interfere with the movements of the heat currents. Sixth, to prevent interruption of the movements of the heat currents by the clogging of the interstices between the coals, or lumps, or pieces of lignite, shale, or other similar substances, by the condensation of the heavy vapours distilled from them. Seventh, to promote the rapid efflux of the vapours from the distilling chamber and, by carrying them away from the inflowing heat as rapidly as they are thrown off, prevent their dissociation and the formation of gaseous products.

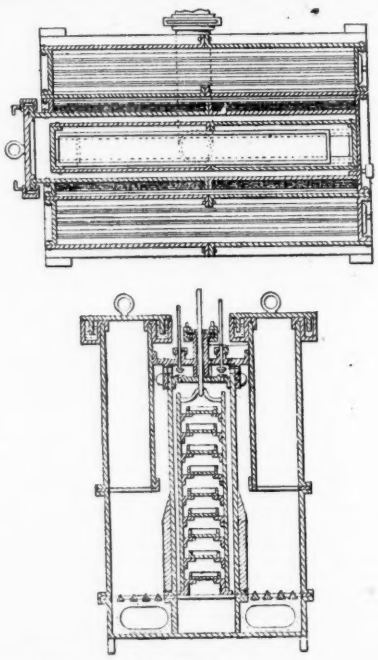
In previously suggested processes for the distillation and carbonization of materials of the kind indicated, the patentee says it has been recognized that it is advantageous to treat the materials, in small quantities, separate from each other and submitted at relatively low temperatures to the action of currents of neutral gases, which do not contain free oxygen. In these earlier processes, the chambers containing the materials have been in some cases externally heated; but in all cases the hot gas has been generated in non-contiguous apparatus. By the present process, the distilling chamber is heated from the outside by means of a contiguous furnace, and this furnace also acts as the generator for the heated gas supplied in a continuous current to the chamber.

In carrying out the process, the cannel (for example) is placed in a casing open at the top and bottom, and enclosed in an air-tight chamber. A heat producing apparatus is employed; and the products of combustion are carried into the casing and caused to impinge upon the coal in the casing, by passing over and laterally through it. The casing connects with an exhaust pipe that leads to an exhaust-blower, which draws the vapours out of the casing as fast as they develop, and drives them through a suitable connecting pipe into a condenser. The charge is placed in the casing and divided into relatively small bodies, which are isolated from each other, so that a passage is formed between the separate bodies for the heat-currents. The temperature is kept below the point of incandescence or red heat—it should range from about 650° to about 800° Fahr. When the temperature is within these limits, the exhaust-blower is started and driven at a high speed, thereby reducing the pressure in the distilling chamber and causing the heated products of combustion to enter the casing, flow through it over and under the bodies of coal, and impinge upon the coal, and thus distill therefrom the vapours which, as they develop, mingle with the heat-currents, and are caused to flow with them out of the distilling chamber and are driven by the exhaust-blower to a condenser, or to two or more condensers, where the vapours are condensed. The temperature being from 250° to 350° Fahr. below red heat, "neither tar nor naphthalene, benzol, sulphur, or other gaseous product is produced." The effect of these relatively low temperatures is to cause vapours and sprays of the heavy oils to be drawn out of the coal; and these are swept rapidly away from the points where they develop, and are carried out of the distilling chamber before dissociation can take place.

The apparatus (as shown) comprises an exterior structure in which are fire-chambers, heat-flues, fuel magazines, a compartment between the fire-chambers and the heat-flues, and a trough below the compartment, into which the vapours descend on their way to a pipe leading to an exhauster, which forces the fires and the heated products of combustion into and through the casing, and in contact with the coal therein, and also draws the vapours out and drives them to the condenser. The apparatus also comprises a casing that fits into the compartment; and the material to be distilled is placed therein. The casing is adapted to be readily and quickly moved into, or withdrawn from, the compartment.

The operation of the apparatus is as follows: The casing rests, when in the compartment, on a base-frame as shown. To move it out





Wurts's Plant for the Distillation of Coal and Other Hydrocarbonaceous Substances.

of the compartment for the purpose of putting the material on the trays, it is lifted by means of the pulley until it is suspended just above the base-frame, and (the door of the compartment having been previously removed) the casing is run out of the compartment by means of the trolley. The trays are then filled with cannel, heaped up more or less. The trays are then carefully adjusted so that a zig-zag passage is formed through the casing. The door is then put in place, and the casing run back into the compartment and lowered until it rests on the base-frame. The fires are then started up, and the dampers in the pipes (only one of these pipes and dampers being shown) leading from the draught openings to the stack (not shown) are opened for a short time to quicken the fire. When the temperature in the apparatus reaches (say) 650° Fahr., or below red heat, the dampers are closed, and the exhaust-blower started and driven at a high speed. The effect of this is to draw the air through the fires and the hot deoxidized products of combustion up through the heat flues, then through perforations into the valve chambers, then downward into the casing past the valves, through the zig-zag passage, and through the main casing. In passing downward, the products of combustion necessarily pass over and in contact with the coal on the trays to the spaces between the trays and the end walls of the casing, and descending through these spaces pass in the opposite direction under the bottoms of the trays. Thus the coal in each tray is exposed to the rapidly moving currents of the hot products of combustion; and the action of the heat in drawing out the oils is continuous and rapid. The temperature not being sufficiently high to produce tar or dissociate the initial products, no naphthalene, benzol, or other gaseous product is formed; but large quantities of vapours of oils and waxes and phenols are produced.

The operation is said to be of very short duration compared to that of a white-hot gas-retort, "in which the heat is largely expended in the work of dissociation of the first products."

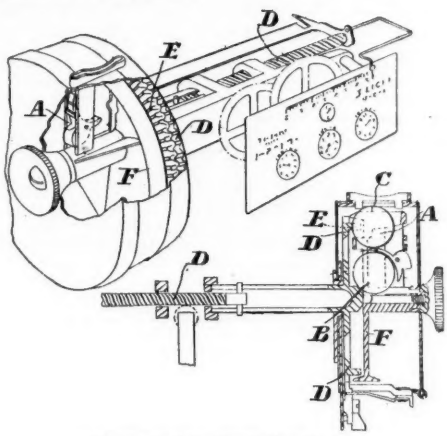
When the coals are distilled, "large amounts of a very valuable coke are produced, which (being the residuum of the distillation of the coal at a comparatively low temperature) is hard, porous, free-burning, and practically devoid of volatile matter, and differs in many essential respects from the coke produced in coke-ovens and gas-retorts.

Coin-Freed Gas-Meters.

DUNCAN, R., of Acock's Green, Birmingham.

No. 8197; April 5, 1906.

This invention has reference to coin-freed gas-meters, in which the gas is liberated by means of pennies or halfpennies—the latter, when in use, standing one upon the other. The present improvement has for its object to arrange for the introduction of thin or worn halfpennies, which have hitherto been liable to wedge together—the principle being the same as that involved in the inventor's prior patent (No. 9373 of 1905), in which an indicator lock is adapted to be operated by halfpennies as well as pennies.



Duncan's Coin-Freed Gas-Meter.

A perspective view of the mechanism of the meter, and a sectional back elevation showing the positions of two halfpennies when in the meter, are given.

The operation by a penny is similar to that now in general use; but for two halfpennies the casing or slot A upon the wheel part E, which the coin enters, is provided with a crescent-shaped pivoted lever, so weighted or arranged that the lower part is engaged by the first halfpenny B, and held in such a position that the upper part forms a support for the second halfpenny C. When in this position, the latter operates the mechanism D for adjusting the supply of gas in the same manner as in the case of the penny—*i.e.*, by engagement with the serrated surface E; while in the case of the release of the two halfpennies, the weighted lever is so arranged that, upon the further rotation of the wheel part F, both coins are free to fall out of the slot or casing in the ordinary manner.

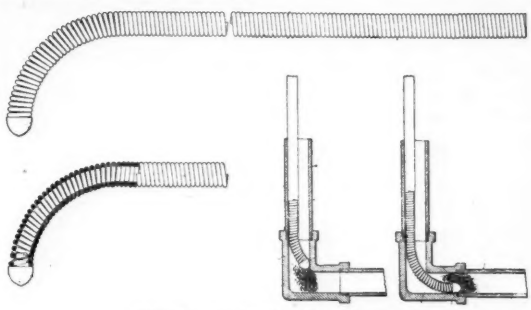
Removing Obstructions in Gas Piping, Tubes, and the Like.

WARD, E. A., of Handsworth.

No. 5116; March 2, 1906.

This invention relates to instruments for removing stoppages in gas, water, and other pipes, tubes, &c., particularly such as have bends, elbows, angles, or other curved parts.

As shown, the tool or implement is formed from coiled spring wire; the body part which is normally straight has such a degree of inherent elasticity that it will bend freely in any direction, but always recover its normal straightness on the bending stress being relieved. The pilot or leading end is made from the same length of metal as the body of the instrument, but is, in process of manufacture, bent to a curvature suitable for giving a lead to the body of the appliance in passing through pipe bends or angles, and is made to take a permanent or definite set in such curved form prior to the spring metal being hardened and tempered. The result is that, when the curved spring pilot end is forced to assume a position more or less in line with the body of the appliance, it becomes tensioned (more or less, in proportion to the extent to which it is straightened), and remains in this condition so long as it is under restraint; but on the straightening force being relieved, then the reaction of the spring metal restores the piloting end to its normal curvature. This is for facilitating the passage of the tool through bends, curves, or elbows, by introducing the end into a straight part of a pipe in a more or less straightened, and therefore tensioned and active, condition, so that when, on being forced through the pipe, it meets with a bend or angle, the restraining influence of the straight portion is relieved, and the pilot end immediately assumes its curved form, which "enables the implement to easily negotiate the passage through the bend or angle."



Ward's Pipe Obstruction Clearer.

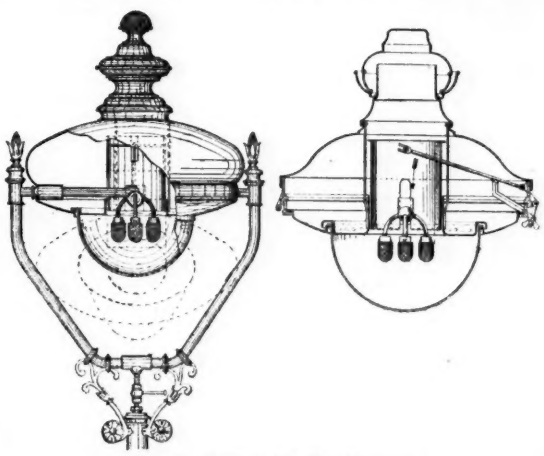
The illustration shows: (1) the specially formed pilot or leading end of the same upon clearer; (2) a part section of the pilot end; (3) the position which the normally curved pilot end of the appliance assumes with respect to the body part when being passed through a straight length of piping, or before reaching an angle or bend; and (4) how the pilot end gives lead to, and facilitates the passage of, the implement round an elbow or right-angle junction piece on being relieved from the restraining influence of the straight part of the pipe into which it was introduced in a partially straightened, and therefore tensioned, condition.

Inverted Incandescent Gas Street-Lamps.

RECH, F., of Brühl, near Cologne.

No. 14,877; June 30, 1906.

In the street-lamp illustrated, the two arms of the lamp-post, made from gas-tubes and conveniently bent, are connected with the gas-supply tube within the lamp-post. The upper ends of the two arms are connected with a horizontal gas-tube on the left side and with a short piece of gas-tube on the right-hand side; and the roof of the lamp may be fastened on to these tubes. To a tubular connection in the middle of the lamp is attached several inverted burners and incandescent mantles by means of bent tubes. A mixing-chamber of any known construction is disposed on some convenient point of the gas-tube, and is thus placed outside the path of the waste gases, which escape upwards from the mantles within the globe, so that they do not prevent



Rech's Inverted Gas Street-Lamp.

the fresh air from entering the mixing-chamber. A movable chimney is vertically guided in the central border of a plate suspended from the roof by rods, and this may cover the globe. The chimney is provided with a slot in which a horizontal gas-tube engages and whereby it is guided. A horizontal bar passes through the chimney, and is secured therein in any known manner. This bar engages in a slot at the free end of a lever mounted on the inside of the roof so as to rock. It passes through a slot in the chimney as shown. The ring carries an arm adapted to act upon the lever.

In the normal position (shown) of the reflector, the arm will hold

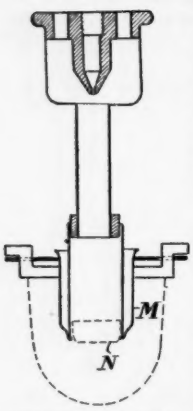
the lever, and thereby the chimney, in the uppermost position. When, for inspecting or cleaning the interior of the lamp, the nut is unscrewed and a bolt is turned out of its slot, and the reflector, with the globe, and the arm is turned downwards, the arm permits the lever with the chimney to lower, until the latter rests on the border of the plate, in which lowermost position it will surround the mantles and protect them from external influences. On turning upwards the reflector, with the globe, of course, the lever with the chimney will be returned to the initial position by the arm.

Inverted Incandescent Gas-Burners.

HADDAN, H. J.; a communication from the Aktien-Gesellschaft, vorm C. H. Stobwasser and Company, of Berlin.

No. 19,406; Aug. 30, 1906.

This invention consists in the insertion of a piece of gauze in the burner, to prevent back-firing. But the gauze (instead of being placed inside the burner as hitherto) is situated at the mouth, which "not only prevents back-firing, but, by its position, causes the flame to assume a spherical shape, so that pressure is uniformly distributed over the inner surface of the mantle." Novel means are also claimed for preventing overheating of the burner-tube, by means of a jacket separated from the tube so as to form a heat-insulating space.



Stobwasser's Inverted Burner.

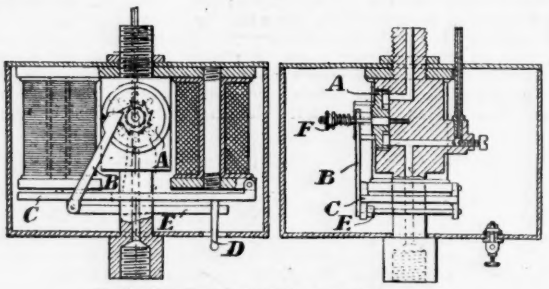
At the orifice of the burner shown is arranged a piece of gauze N, and the tip is surrounded by a jacket M. To the latter is connected a vertically adjustable support for the incandescent body. The adjustability of the support allows of regulating the extent to which the burner projects into the mantle. The gauze prevents back-firing at the time of ignition, and also allows of using a highly efficient mixture of gas and air without danger of back-firing during the use of the burner. The mantle is preferably so adjusted that the burner-orifice is approximately at the centre. An intense and uniform lighting effect is thus obtained—the spherical flame produced surrounding the lower part of the burner-tip and heating it to a high temperature. Back-firing or inversion of the flame is prevented by the heat-insulating space between the burner-tip and the jacket. Without the insulating space it would, the patentees remark, be impracticable to use the gauze with advantage.

Lighting and Extinguishing Gas-Burners.

ABEL, K., of Vienna.

No. 16,760; July 25, 1906.

The lighting and extinguishing of gas, according to this invention, is effected by a switch wheel actuated by electro-magnets—the wheel forming a rotary valve, the working surface of which is formed with a circular channel having radial grooves diverging from it, which at each motion of the switch alternately connect or disconnect two apertures in the gas-pipe, which ordinarily are not in communication with each other.



Abel's Gas-Burner Lighter and Extinguisher.

The body of the burner is formed with two passages, through which the gas comes to the burner and passes to the flame, and the adjacent ends of which open outwards into a recess in the side of the burner, by cross passages. In the recess a rotary valve A is mounted. The outer side of the valve is formed with ratchet-teeth, with which a pawl B, connected by a pivot to the armature C, can engage. The valve on its working face is formed with a circular groove having four radial grooves radiating from it and arranged at an angle of 90° to each other. The armature is connected at one end by a pivot direct to the pole of a magnet, and is provided with a stop D for the limitation of its movement. On the pivot of the pawl B is mounted a bar or rod E, through the weight of which the catch is caused to engage with the ratchet-wheel. The end of the pawl is formed with two parallel faces—the lower face corresponding to the obliquity of the ratchet-teeth, and the upper face, when the catch is in its highest position, being pushed against a stationary stop pin. In this way it arrests the lift of the pawl, and ensures "an accurate and regular movement of the ratchet-wheel," and prevents further displacement of the valve through any upward movement of the pawl. If the opposite grooves coincide with the cross passages, connection between the axial passages is made; but when the valve A is turned another 45° (due to the ratchet being moved forward a tooth), this communication is interrupted. The alternate connection and disconnection are repeated every time the valve is moved forward. Owing to the connection of the armature to one of the magnetic poles, the same polarity is imparted to it; and so the power of attraction of the other pole is increased. A spring F presses the valve A against its seat, and in this way acts as a packing.

The head inserted in the burner (which is formed in the ordinary way) is provided with a hollow cylindrical wire screen, through the bottom of which passes a lighting tube or bye-pass; while the top edge of the burner-head projects above the end of the lighting tube or bye-pass and so protects the flame.

APPLICATIONS FOR LETTERS PATENT.

365.—GROCOTT, R. T., "Inverted mantle suspender." Jan. 7.
370.—HELPS, G., "Gas lamps and burners." Jan. 7.
451.—BILLINGTON, W. J., "Inverted burners." Jan 7.
476.—EHMANN, C. P., "Inverted burner nozzles." Jan. 8.
484.—CALLCOTT, C. W., "Combined coal cooking-range and gas warming-stove." Jan. 8.
566.—FARNSWORTH, J., "Carburetted air." Jan. 9.
639.—COWPER-COLES, S. O., "Extraction of sulphur from sulphur compounds." Jan. 10.
646.—BRUCE, A., "Air-gas machines." Jan. 10.
650.—THORP, T., "Rotary meters." Jan. 10.
651.—WOODALL, H. W., and MOON, P. G. G., "Testing mantles." Jan. 10.
666.—KRÖNER, A., "Determining the intensity of gases." Jan. 10.
702.—BERNHARDT, P., "Regulator for gas-nozzles." Jan. 10.
723.—MALDEN, W. J. & A., "Treating tars and pitches." Jan. 10.
800.—COLLINS, H. A. D., "Gas-retorts." Jan. 11.
805.—MIEVILLE, M. F., "Carburetted air." Jan. 11.
826.—COOPER, J., and YOUNG, W., "Incandescent burners." Jan. 12.

Coventry Water Scheme.

The Coventry City Council held a special meeting last Tuesday for the purpose of confirming the resolution passed on Dec. 4 sanctioning the water supply agreement with Birmingham. Alderman Bird, the Chairman of the Water Committee, moved the resolution, which, he said, had been already adopted by 34 votes to 10 at a meeting of the Council, and by 76 votes to 2 at the town's meeting called to take the matter into consideration. Mr. Band wanted to know if it was right for Corporation officials and members of the Water Committee to vote at the town's meeting; and Mr. Grant sought an explanation as to the charge for water in the scheme—suggesting that this showed nearly 100 per cent. increase where rateable value was concerned. Alderman Maycock said that members of the Water Committee, and also officials, had as much right to attend and vote at the meeting as anyone else. The Town Clerk informed Mr. Grant that it did not follow the charges made for water would be up to the maximum amount that could be levied. He could not say whether the maximum scale of charges was less than that made by the Birmingham Corporation. The latter had had no hand whatever in fixing it. The scheme was approved by a large majority.

Terrible Earthquake in Jamaica.

News reached England last Wednesday morning of the occurrence, on the previous Monday afternoon, of an awful earthquake in Jamaica, by which Kingston had been destroyed. Subsequent accounts furnished details of the terrible calamity, which is the second of the kind by which the island has been visited, and the third which has happened in the western hemisphere within twelve months. From these we learn that not only has there been great destruction of property, but unhappily considerable loss of life. Kingston had long been the most important town in the British West Indies. It had a population of nearly 50,000, and covered altogether an area of more than 1000 acres sloping to the sea on the northern side of a landlocked harbour capable of accommodating the largest ships. Built on a bed of gravel and well drained, it had enjoyed an enviable reputation for freedom from malaria and for general healthiness. The streets ran either north and south or east and west at right angles to one another. The principal among them had been reconstructed in recent years and paved with brick, macadam, or asphalte; the water supply was improved and increased; and electric cars traversed the principal thoroughfares. The city in general was lighted with gas; but in many of the more important buildings electric light was in use. The gas-works are owned by the Government, and according to the last statistics to hand, the annual make of gas was about 18 million cubic feet. There were only 250 consumers, out of the population named, and 700 public lamps, of which 100 are fitted with incandescent burners. The telegrams which have been received do not furnish very many particulars as to the extent to which the gas supply has been affected; but one thing is certain—that serious havoc has been played with both the manufacturing and the distributing plant. The water reservoir was wrecked, and the mains were broken in all directions; and consequently fires had to be left to burn themselves out. Relief measures were promptly organized; and, notwithstanding the wreck produced by the calamity with which the island has been visited, one of the latest telegrams from the locality contained the hopeful message that there was no reason why confidence in its growing prosperity should be diminished.

The Want of a Gas Crematorium.—Referring to the remarks on the above subject quoted in the "JOURNAL" last week from the writer of "Notes on Gas Lighting" in the "Ironmonger," Messrs. Wilsons and Mathiesons, Limited, in the course of a letter to that publication, say: "We have suggested a remedy for this apparent defect to a prominent member of the Smoke Abatement Society—namely, that there cannot be a better crematorium for refuse than the present fireplace in the kitchen, and that all that is required is a bunsen burner, arranged with a hook to suspend on the front bars, so that the flame will play between the grate-bars. The burner could be attached with a piece of india-rubber tube to a small cock inserted in the top of the gas-cooker, which is usually fixed near the fireplace. The gas could then be lighted, and the whole of the refuse burnt in the fireplace as if a fire were lighted—the chimney being quite long enough to take any obnoxious smell above the top of the house."

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by our Correspondents.*]

Open Ventilators in Retort-House Roofs.

SIR,—With regard to what is stated on p. 146 of the "JOURNAL," that the original introduction of the above "was no doubt more by accidental circumstances than design," may I point out that the description of the Windsor Street works, which you published in 1886, shows (Plate 6) this feature in the design of the retort-house roofs. This, however, was not original so far as I am concerned; but if I rightly recollect, it was copied from a roof constructed by Mr. Morton at the Nine Elms Gas-Works. At all events, I believe that I had seen it somewhere. But what I have said shows that the above observation is scarcely correct.

CHAS. HUNT.

15, *Victoria Street, S.W., Jan.* 18, 1907.

Institution of Civil Engineers Engineering Conference and the Gas Institution Meeting.

SIR,—The announcement has just been issued that the fourth Engineering Conference of the Institution of Civil Engineers is to take place in London on the 19th, 20th, and 21st of June next.

It is much to be regretted that these dates coincide with those decided upon in October last for the annual meeting of the Institution of Gas Engineers, to open in Dublin on Tuesday, the 18th of June.

WALTER T. DUNN,
Secretary Institution of Gas Engineers.

39, *Victoria Street, S.W., Jan.* 17, 1907.

Gas Testing.

SIR,—In the Acts of Parliament which govern the statutory undertakings of corporations and companies supplying gas, there is a clause inserted prescribing the method of testing; and up to the session of 1906 the clause in the Model Bill issued by the House of Lords was as follows:—

> "The prescribed burner shall be [ ] or such other burner as shall for the time being be approved by the Board of Trade."

The prescribed burner usually adopted was the "London" argand burner No. 1; but in 1905, Mr. Carpenter invented his "Metropolitan" argand burner No. 2; and this burner has been substituted in the Model Bill for the session of 1907, and the clause now reads as follows:—

> 27. (1) The quality of the gas supplied by the company shall, with respect to its illuminating power, be such as to produce, at the testing-place, when burned at the rate of five cubic feet per hour, a light equal in intensity to the light produced by fourteen sperm candles of six to the pound, each consuming 120 grains of sperm per hour, and shall be in all respects in accordance with the provisions of the Gas-Works Clauses Act, 1871.
>
> (2) For testing the illuminating power of the gas, the burner to be used shall be that known as the "Metropolitan" argand No. 2; the photometer shall be the bar photometer (or the table photometer); the standard light shall be that supplied by Harcourt's ten-candle pentane lamp; and in making the test the burner shall be so used as to obtain from the gas, when burned at the rate aforesaid, the greatest amount of light: Provided that the Board of Trade may, on the application of the company or the local authority (the council or any five consumers), approve the use of any other burner, photometer, or standard light, which may appear to the Board to be equally or more suitable for the testing.
>
> (3) The company shall, before supplying, or within three months after beginning to supply, gas under this Act, provide all the apparatus required by this Act for the testing of gas, and shall at all times keep the same in proper order and repair.

I doubt very much whether gas consumers outside London, or the local authorities who represent them, are fully aware of what this change of burner means. The effect is that the "Metropolitan" argand burner shows the gas thereby tested to be from two to three candles higher in illuminating quality than when tested by the "London" argand burner. In other words, the corporation or company who now have to supply a 14-candle gas as tested by the "London" argand burner can, by adopting the new burner, distribute gas of a lower quality by two or three candles, and of an equally lower calorific value, than that which they are now supplying.

The change in the method of testing the gas will enable the gas-supplying corporation or company to obtain a higher yield of gas per ton of coal carbonized with the present coal they use, or they will be able to purchase cheaper coals and obtain the same yield of gas but of a lower quality.

The result of this is a considerable increase in the profits of the corporation or company, while the consumer gets an inferior quality of gas.

It is, of course, said that a lower quality does not matter where incandescent burners are used; but although the number of incandescent burners is steadily increasing, there is still a large number of flat-flame burners in use, and these burners will continue to be used under certain circumstances.

There will, however, be some loss in the illuminating quality of an incandescent burner by adopting the "Metropolitan" argand test-burner; and there will also be a loss in calorific value, which I am informed might in some cases render the gas almost valueless for cooking purposes or for gas-engines.

"What's in a name?" In the present instance, apparently there's a good deal of difference. A gas consumer probably knows as little about the "London" argand burner as he knows about the "Metropolitan" argand burner; and he will not concern himself about either, unless it be clearly pointed out to him what the difference in the burners means.

As I said above, I very much doubt whether he is aware of the difference. Gas companies are only just understanding it; and, under the first Model Bill clause I quoted, they are beginning to apply to the Board of Trade to sanction the alteration of burner. I contend that these applications are being made, not in the interests of the consumer, but solely for the purpose of increasing the profits of the company or corporation supplying the gas.

I recognize that your paper is not the best medium for reaching the gas consumer; but I would suggest to those companies or corporations who propose applying for sanction to adopt the new burner, that they should either increase the illuminating power to 16 candles or reduce the price of gas by the equivalent of the additional profit made.

CHARLES E. BAKER.

54, *Parliament Street, S.W., Jan.* 14, 1907.

[As it is highly desirable, for uniformity of testing, that the Metropolitan No. 2 burner should come into general use as speedily as possible, it cannot be too widely known that the model testing clause adopted by Parliament after full consideration, prescribes the use of this burner. We, therefore, publish the above letter; although the text of the clause has already appeared in the "JOURNAL." From his letter, it might be inferred that Mr. Baker is not aware that the Metropolitan No. 2 burner has been adopted by the Gas Referees for testing the gas of the three London Companies, under the provisions of the London Gas Act, 1905. That which is good for London in this respect should be good also for the Provinces. Whether or not companies or corporations seeking to substitute this test-burner for any other should either increase the nominal illuminating power of their gas or reduce its price, as suggested by Mr. Baker, is a question as to which he is scarcely called upon, even if competent, to form an opinion.—ED. J.G.L.]

The New Gas-Works at Hathersage.—We have received a further letter on this subject from Mr. T. Brown, of Matlock. Referring to the statement in the letter of Messrs. J. Firth Blakeley and Co. which appeared last week, to the effect that the No. 11 gauge sheets inadvertently used in the cupping of the gasholder were "replaced within a week of being found wrong," Mr. Brown says "the whole ring of sheets was condemned on the 31st of October, but the new sheets to replace did not arrive at Hathersage until the 16th of November." This matter has now been sufficiently debated in our columns, and any further questions in dispute between the parties must be settled elsewhere.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

Monday, Jan. 14.

(*Before Mr. Justice* JELF.)

Chester Water-Works Company v. Guardians of Chester Union.

In the "JOURNAL" for the 1st inst. (p. 42), we reported the arguments and evidence in this case, at the conclusion of which his Lordship reserved judgment, which was delivered to-day in favour of the plaintiffs.

Justice JELF said the action was brought by the Chester Water-Works Company against the Guardians of the Poor of the Chester Union (1) for a declaration that, on the true interpretation of the Company's statutes, the defendants were not entitled to require the Company to supply, and the Company were not bound to supply, the Chester Workhouse with water otherwise than by meter or special agreement; and (2) to recover £491 11s. 9d. on account of water supplied to the workhouse from Jan. 1, 1902, to the date of the writ, July 6, 1904. In the statement of claim, this sum was claimed as damages for wasting water passing through the meter at the workhouse. But the case had been argued on both sides, without objection, as if there had been an alternative claim for money due for water supplied by contract. He, therefore, treated the claim accordingly, but without prejudice to the defendants' rights under the statute mentioned hereafter. He held that he must, of course, treat the statement of defence as also amended so as to make the statute 22 and 23 Vict., cap. 49, sec. 1, applicable to the amended claim. His Lordship reviewed the circumstances under which the action had been brought, and said it was contended on the part of the plaintiffs that many of the purposes for which the water was required and used at the workhouse were not domestic, and that some were trade or business purposes; and that, even if the defendants were entitled, irrespective of section 22 of the Act of 1874, to a supply for domestic uses, to be paid for separate from a supply for other purposes, which was to be paid for in addition according to the statute, or by meter or special agreement, yet the section referred to prevented the Company from being bound to supply water to the workhouse otherwise than by meter or by special agreement, because a part of it was used for trade or business purposes. It was contended by the defendants that they were entitled to a supply of water for domestic purposes, though they admitted that for non-domestic or trade or business purposes they would have to make an extra payment, or pay by meter or special agreement; and, as they could not help admitting that some of the purposes were not domestic, they maintained that there would have to be separate supplies to meet the two sets of requirements, and that they would have to be paid for

on different bases. They did not, however, admit that any of the purposes were trade or business purposes; and therefore they said section 22 did not apply. Many decisions had been cited, and a number of points had been raised; but, in the view he took of the law and the facts, the real question lay in a nutshell. Most of the facts were undisputed; such controversy as there was turning upon inferences of fact rather than upon the facts themselves. With a great deal of the argument of Mr. Danckwerts for the defendants, he was in complete accord. For instance, the authorities showed that in cases arising under Water-Works Acts the nature of the purposes for which the water was required governed the rights of the parties rather than the nature of the premises to be supplied or the character of the occupiers. And he thought that, apart from section 22 of the Act of 1874, the defendants had a right to demand a supply of water to the workhouse for domestic purposes, payment for which was to be based on the annual value of the premises; and that they also had a right, subject to the provisions and restrictions of the Special Acts and of the Water-Works Clauses Acts, 1847 to 1863, to a supply for non-domestic purposes, including trade or business purposes, for which extra payment was to be made, according to statute, or by meter or special agreement. It was true, he thought, that great practical difficulties might arise in carrying out a double system, though this was denied by the defendants. But he could see nothing in the Acts (apart from section 22) to curtail the rights of the consumer in this respect; and he should certainly not differ from the opinion of Mr. Justice Buckley on this point in the case of the South-West Suburban Water Company. In his opinion, the present case turned wholly on the section he had named, no similar section to which was to be found in the Acts mentioned in any of the cases cited; and it might be that this section was introduced for the very purpose of avoiding the difficulty of a double supply. The first question was: Was this workhouse a dwelling-house? In his opinion, and so far as it was a question of fact, he found that for the purposes of these Acts it was—that was to say, the whole tenement, occupied as a whole by the defendants, and in respect of which they required water. An attempt had been made to say that it might be split up into several distinct dwelling-houses, and that the rights might differ as regarded the different parts. He did not think this point was raised in the pleadings; but, even if was, the contention was, in his opinion, untenable. The defendants' relations towards the plaintiffs depended on the ownership and occupation of the workhouse as a whole; and he thought the expression "or part of a house," in section 43 of the Act of 1857, referred to cases where there was a separate tenement by lease or otherwise. As to the workhouse being a dwelling-house, he was supported by the view taken by Mr. Justice Buckley in the case already cited, and also by the cases of *Lowe v. Lambeth Water-Works Company* and *Liskeard Union v. Liskeard Water-Works Company*. The next question was: Was any part of this dwelling-house used for any trade or business purposes for which water was required? He was of opinion, and he found as a fact, that the whole of it, and therefore each part of it, was used for business, if not for trade, purposes for which water was required. Mr. Danckwerts had said that this was only true if "business" was used in a loose sense, and that this workhouse was not used for business purposes within the meaning of section 22. But he (his Lordship) thought that, in construing similar statutes, similar institutions had been held to be businesses, especially by Mr. Justice Buckley in the case already cited; and if this, as a whole, was a business, all the water used, except what was employed for domestic purposes, was for the business. Moreover, he was of opinion, and he found as a fact, at all events, the dealing in pigs, for which part of the workhouse was used, and for which water was required, was a business, even if it was not a trade; and the use of the Lancashire boilers, and the various things done by them, including the heating of the wood-chopping shed, was a business. It was not necessary for the decision of the case to go *seriatim* through the different purposes for which water was required, and decide which were domestic and which were non-domestic, or whether any of them, besides those already dealt with, were trade or business purposes. Some were admitted to be non-domestic; and his opinion was that some of these were trade or business purposes, which brought the case within section 22 of the Act of 1874. That section did not contain the words "non-domestic purposes;" and this might be because there was no great difficulty in adding to "domestic" supply "non-domestic" supply (so long as it was not trade or business)—for example, a supply for gardens, fountains, &c.—payment for which could be easily added, while a trade or a business supply was much more difficult to combine with domestic supply as regards payment. For these reasons, he thought that section 22 did apply to the present case, and that plaintiffs were entitled to the declaration for which they asked. It remained to consider the relations of the parties at the date of the writ (July 6, 1904), as regarded the plaintiffs' right to recover damages for waste, or a sum due for water supplied. In the controversy, which was sufficiently shown by the correspondence, the defendants were, in his opinion, clearly wrong, even apart from section 22, in demanding that the meter should be removed, and that all the water should be used, as before, as a domestic supply for which payment should be based on annual value. According to the scale, this meant that they should have the same water as before, paying for it about £50 a year instead of about £200. And, further, if his decision as to section 22 was correct, they had no right, under existing circumstances, to demand a supply for domestic purposes at all on the basis of annual value, even if they were ready to pay besides for the non-domestic or business supply, which readiness, however, was not proved. On the other hand, he thought that plaintiffs put their case too high when they said that the old agreement was binding, and that the defendants could not get away from it. Their real case was that, if the defendants chose to go on taking the water as before, they were, by doing so, impliedly contracting to pay for it on the old terms. He thought, therefore, there was no case for damages for wasting water; but he found as a fact that the defendants took the water on the old terms by implied contract. He would give the plaintiffs, on the pleadings as amended, judgment (subject to verification as to amount) for £491 11s. 9d. as due at the date of the writ; but this again was subject to the defence of the statute. All questions as to requirements to prevent waste, &c., had been, by consent, postponed; and he thought it unnecessary to deal with this part of the case. Finally, there was the question of the Act 22 and 23 Vict., cap. 49, sub-sections 1 and 4. The first section *primâ facie* prevented any debt or demand from the Guardians of a Union being paid (and therefore from being sued for) except within the half year, as defined, in which it was incurred or became due, or within three months afterwards, subject to the extension by the Poor Law Board for a period not exceeding twelve months, which extension had not been obtained. But, by section 4, if any person claiming any debt or demand should have commenced, or should thereafter commence, proceedings in any Court of Law or Equity within the time limited, and should, with due diligence, prosecute such proceedings to judgment or other final settlement of the question, such debt was to be satisfied by the Guardians, notwithstanding that it might have been recovered, or such final settlement arrived at, after the expiration of the period. If the action brought on the 5th of July, 1904, was "a proceeding" within section 4, the Guardians could pay, and therefore would be bound to pay, the last quarter's water-rate, due June 25, 1904, which he was told amounted to about £58. But he thought the action, till amended by adding the alternative claim for the price of the water supplied, was not such a proceeding. The debt or demand for the price of the water was not, till then, sued for, either in the writ or in the statement of claim. The claim was quite different—namely, for unliquidated damages for waste of water; and this he had held could not be established. Therefore, the plaintiffs could not, in his opinion, recover even one out of the ten quarters of water-rate which would be otherwise due on July 6, 1904. The cases relied on by Mr. Randolph in order to show that there was no ascertained debt till he (his Lordship) had determined the principle, were wholly different from the present one, where an amount was due and payable, whether on a *quantum meruit* or otherwise liquidated. He therefore came most reluctantly to the conclusion that the plaintiffs were, by this statute, precluded from recovering any part of the £491 11s. 9d. sued for, and that, upon this part of the case, judgment must be for the defendants. But, as the plaintiffs had succeeded on the main question in the cause, and were entitled to the declaration they claimed, he did not deprive them of any of the costs of the action, especially as the defendants had been lucky enough, in consequence of the Statute, to obtain nearly £500 worth of water for nothing. His judgment, therefore, was for the plaintiffs for the declaration asked for on the claim, and also upon the counterclaim, with costs.

Disputed Monazite Sand Contract.

About two years ago, Mr. Justice Bigham had before him, in the King's Bench Division of the High Court of Justice, an action brought by the United Gas Improvement Company of Philadelphia against Mr. John Gordon, of South Audley Street, London, for damages for an alleged breach of an agreement in regard to the supply of monazite sand. After occupying the Court for several days, his Lordship, as reported in the "JOURNAL" at the time, gave only a partial decision, and certain points were left open. Since then the matter has been before him on various occasions; and as the parties were unable to agree upon the issues to be left to him, he decided to determine them for himself. The agreement chiefly in question was dated April 12, 1902, under which the defendant agreed to supply four German manufacturers of thorium with their "requirements" of monazite for a period of five years. Gordon was the owner of certain properties containing monazite sand deposits, which he assigned to the plaintiff Company for £275,000, of which £25,000 was paid on account; and he undertook not to export monazite to anyone but the Company. Shipments were duly made, and were disposed of by the Company. But later on the latter gave notice to Gordon that they did not intend to deliver any more. Thereupon Gordon made some shipments himself, so as to keep faith with the German firms. The point was whether the Company were entitled to require him to account for the profits resulting from these transactions, which were alleged to be shipments in excess of the buyers' requirements. This was decided a few days ago. His Lordship, having carefully considered the terms of the agreement, came to the conclusion that the plaintiffs had not kept to the terms of the agreement, and therefore had lost any remedy they might otherwise have had against the defendant under it. He therefore gave judgment for the defendant, with costs.

Stealing a Gas-Meter at Greenock.

In the Police Court at Greenock on Tuesday last, before Bailie Lemmon, John M'Laughlin, a fish hawker, and Peter M'Laughlin, a labourer, were charged with stealing a gas-meter and 15s. 4d. in money from the shop at No. 43, Vennel, Greenock, occupied by Bernard M'Laughlin. They pleaded "Guilty." The prosecutor described the charge as a serious one. It seemed, he said, that the two accused and a man named Currie made a resolution to enter the premises. Currie was known to M'Laughlin, and he got into the shop while it was being closed, and removed the bolt from the back door. The two accused subsequently entered by this back door, and took away a prepayment meter with the money in it. The gas escaped during the whole night; and when Mr. M'Laughlin's representative went to the shop in the morning he found he could not light the gas. He asked another man to assist him, and on a match being lighted an explosion followed, as a result of which the man who had come to assist was severely burned. One of the accused complained that as Currie was the man who opened the door, he too should have been charged. The prosecutor replied that his information was that Currie was not present when the theft was committed; that Currie certainly knew that the accused were in the shop, but, on the approach of a policeman, he disappeared. The two accused were sent to prison for 30 days.

The Montreal Light, Heat, and Power Company have declared a dividend for the three months ending the 31st ult. at the rate of 5 per cent. per annum.

MISCELLANEOUS NEWS.

PRESENTATION TO MR. AND MRS. ANDREW MACKENZIE.

On the occasion of the silver wedding of Mr. and Mrs. Andrew Mackenzie, the former of whom has been the representative of Messrs. Alder and Mackay, of Edinburgh, for the past quarter-of-a-century, a deputation of gas managers in Scotland waited upon them at their residence, Craig Dhu, Polwarth Terrace, Edinburgh, on the evening of Thursday last, the bearers of congratulations from, and of handsome presents subscribed for by, about 130 of the managers among whom Mr. Mackenzie's work lies. The presents consisted of a silver tea and coffee service, with a silver salver bearing the following inscription: "Presented to Mr. and Mrs. Andrew Mackenzie, by their friends in the Gas Profession in Scotland, on the occasion of their Silver Wedding, 4th January, 1907;" a gold and diamond pendant for Mrs. Mackenzie; and a gold and diamond scarf pin for Mr. Mackenzie.

Mr. W. BLAIR (Helensburgh), in a few well-chosen remarks, made the presentations.

Mr. MACKENZIE, in returning thanks on behalf of his wife and himself, said he could assure those present that when he was asked to go, as an apprentice, on the road, fully 25 years ago, he did not anticipate that he and his wife would be the recipients of such costly and beautiful gifts as those which had been bestowed upon them. While thanking the donors, perhaps it would be right to say a few words about the friends of the past. He had been thinking of the vast changes which had taken place in the gas profession in Scotland. During the last 25 years there had been fully sixty removals by death. When he started travelling, he did not know many gas managers; but he could never forget the kindly interest shown in him by Bailie Robertson, of Bathgate, on whom he called the first day. There were a number of gentlemen still living who were managers then. There were four who had retired—Mr. Smith, of Hawick, Mr. MacPherson, of Kirkcaldy, Mr. Whimster, of Perth, and Mr. Caithness, of Carnoustie. There were, he thought, almost twenty still in office who were gas managers then, some of them then over the Border. Among these were Messrs. Blair (Helensburgh), Fairweather (Kilmarnock), Hislop (Paisley), Carmichael (Barrhead), Smith (Ayr), Wilson (Coatbridge), Sinclair (Rothesay), G. Taylor (Jedburgh), Napier (Crieff), Robertson (Dunoon), W. Taylor (Forres), M'Allan (Turriff), Ross (Burntisland), Ewing (Greenock), Galbraith (Ardrossan), Deans (Johnstone), J. N. Myers (Saltcoats), C. P. Myers (Troon), and Scott (Markinch). There were, he thought, only four now in the situations they held when he started. These remarks showed how numerous had been the changes going on around them; and yet, amid them all, he and his wife had the satisfaction of knowing that they were still surrounded by many friends. He sincerely trusted Providence would grant that their friendships with each other might long continue.

The company were hospitably entertained by Mr. and Mrs. Mackenzie, and a pleasant evening was spent.

THE EXPLOSION AT THE DUBLIN GAS-WORKS.

The Cause of the Accident.

Last Tuesday, Dr. Louis Byrne, the City Coroner for Dublin, held an inquest on the body of James Sherwood, an employee of the Alliance and Dublin Consumers' Gas Company, who was injured, with a number of others, at the Company's works in Brunswick Street—by the explosion of which some particulars were given in the "JOURNAL" last week, p. 168—and who died in Sir Patrick Dun's Hospital on the 13th inst.

Mr. GERALD BYRNE represented the Company; and Mr. JOHN JACKSON, one of the Inspectors of Factories, was in attendance.

Dr. *T. O. Graham*, the House Surgeon at the hospital, deposed that deceased was admitted at 11.30 a.m. on the 10th inst. in a state of collapse resulting from severe burns caused by an explosion of a purifier at the gas-works. He was detained, and never rallied—dying on the 13th inst., from shock.

Mr. *G. F. A. Waterfield* said he was Assistant-Engineer to the Company. On the previous Thursday morning, about five minutes past eleven o'clock, he was underneath the purifiers on the oxide floor with D'Arcy, who had charge of them. Witness left him shortly afterwards, and was walking down the yard when he heard a rumbling noise. He proceeded in the direction of the sound, and on his arrival at the purifiers he saw flames issuing from the oxide hoppers of No. 4 purifier. He immediately had the gas shut off from all the purifiers, had the retort-lids opened, and the carburetted water-gas plant shut down. He then saw the Chief Engineer, who had just arrived, and informed him of what he had done. All the purifier valves were closed so as to isolate each purifier.

Mr. *W. F. Cotton*, jun., the Company's Chief Engineer, stated that on the morning of the accident he was telephoned for by the Chairman of the Company (Alderman Cotton) to see him at the head office; and after doing so he returned to the gas-works. Just as he arrived, he saw some injured men being removed on drays and waggons. He ordered the Fire Brigade ambulance to be telephoned for, and then obtained particulars of what had happened, which were to the effect that the purifiers were on fire. He ran in the direction of the house, and on his way met two men—Thomas Cummins and Michael D'Arcy—who appeared to be injured. The Medical Officer (Dr. L. J. Farrell) was fortunately on the works and was looking after the injured, and witness requested him to at once get Cummins and D'Arcy off with the others to the hospital. On reaching the purifier-house, he saw at the south or coal gas end a great volume of gas burning underneath; and he at once inquired if all the valves leading to and from the purifiers were closed. He was informed that they were with the exception of one, which he then closed—thus leaving the purifiers absolutely isolated from the other parts of the plant. The Fire Brigade and the ambulance arrived promptly. Witness noticed that the two oxide discharging hopper doors in the bottom of No. 4 purifier were open, and that fire was coming from them. They were closed by the commander of the Fire Brigade (Captain Purcell) and by witness's assistant; thus confining the fire to one box, which burnt out by four o'clock in the afternoon.

In answer to the CORONER, witness said that, as the Company's Chief Engineer, he was responsible for the working of the station. He inspected the place several times daily, and he was frequently visited by the representative of the Home Office, who was present, and who had never pointed out anything which should be done that had not been attended to. He had examined the place since the accident, and had formed an opinion as to the cause of it.

The CORONER: Will you state briefly what your opinion is?

Witness: I carefully examined the place, and I have come to the conclusion that there must have been a leakage from one of the hopper doors. As to how the gas took fire, I should say there must have been a spark, which might have been caused by the hopper door opening, when it might strike the bottom of the purifier, which would be sufficient to cause a spark. At the time the accident happened, we were using the electric light; and if there was a defective wire, that also might have caused a spark, which would have been sufficient to cause the gas to explode.

There was no naked light?—There was none at all there. The nearest naked light would be about 200 feet away.

Why have you the electric light now in use?—About four years ago, there was an explosion in England. Up to that time we had been in the habit of working with a naked gas-light, and I asked my Board to substitute electric lights, which they did.

You considered that was a safer light?—Yes.

What means are there of ventilating this place?—On one side the purifier-house is completely open, and on the Canal Basin side we have ten open ventilators 4 feet square.

Can there, therefore, be any collection of gas there?—There might be a little between the boxes.

Replying to Mr. GERALD BYRNE, witness repeated that the Inspector of Factories had never made a suggestion which had not been attended to. The purifiers were open on all sides but one, and were raised about 16 feet from the ground. There was no roof. Everything had been done to have the best equipment and regulations for the safety of the workpeople.

Mr. JACKSON (to the Coroner): There have been three explosions in England, and the Home Office has recently drawn our attention to the question of purifying-houses. With regard to this particular place, it largely complies with the recommendations made by the Home Office; but I wish to ask the witness some questions.

The CORONER having acquiesced,

Mr. JACKSON then put to the witness a series of questions, which elicited the information that he knew the use of miners' safety-lamps had been condemned, that such lamps had been used at Saltley, Coventry, and Manchester, and that the Home Office had directed that electric torches should be substituted for them. After the Manchester accident, he did not make any alteration in the position of the purifiers to avoid explosion. The boxes were formerly on the ground; but ten years ago they were raised 16 feet so as to get better ventilation.

Mr. JACKSON: Can you suggest anything that would cause the hopper door to open?

Witness: It might not be properly fastened, or the lever may have slipped.

But even if it was only partly open, some gas would have leaked?—Yes.

And did one of the wires pass under the centre of the box where the explosion took place?—Yes; between the two doors.

So that if the gas were leaking, and these wires fused, it would be quite sufficient to cause the explosion?—It would.

The CORONER (to Mr. Jackson): Were you satisfied that the purifiers were in sufficiently good order?

Mr. JACKSON: Before the explosion, I should have said "Yes;" but since then, in view of what happened, I would recommend ventilation between the purifiers.

But up to that time you were satisfied that they were complying with the requirements of the Home Office?—I should say the arrangements were more satisfactory than in the majority of other places, because it is often the habit to put up brick buildings, and when an explosion occurs in one of these more people are hurt or killed by the heavy buildings falling upon them than by the explosion itself. That was the case at Saltley; and I am satisfied that, if there had been such buildings here, out of the seventeen men who were injured very few would be alive to-day. An improvement can be made by having hand electric lamps with a dry battery instead of the wires, which I think were the cause of the accident. I gather that the Company are doing this now.

Witness said that was so. They had, in fact, already got them.

Mr. GERALD BYRNE expressed the sympathy of the Company and everyone connected with it with the families of the poor men who had been hurt. He said he was sure the Coroner and the Jury were aware that the Company always took care to look after such cases, and they would certainly do so in this.

The Jury returned a verdict to the effect that death was due to shock resulting from burns accidentally received at the gas-works, and added a rider recommending the widow of the deceased and his children (of whom there are five) to the kind consideration of the Company.

All the injured men are doing well, and there are now only six in the hospital.

The text of a Bill has been published to enable the Municipal Commissioners of Singapore to borrow $8,145,410 for the construction of water-works, to be divided as follows: $650,000 for the extension of filters, $3,834,460 for the Kalang reservoir and land, and $3,660,950 for the Selitar works

GAS MATTERS IN BIRMINGHAM.

In moving the adoption of the report of the Gas Committee at last Tuesday's meeting of the Birmingham City Council, Alderman Sir Hallewell Rogers referred to the efforts that had been made to get rid of the difficulties which arose by the deposit of naphthalene in the distributing-mains and service-pipes. He pointed out that the trouble occasioned a great deal of inconvenience to the consumers; and in 1900 several thousands were spent in the endeavour to find some remedy. No substantial result was, however, achieved; but more recently a method had been adopted which had succeeded in reducing the number of cases of defective supplies consequent upon the deposit of naphthalene from 23,520 in 1905 to 519 during the current year. There had been no diminution in the gas supply for the present year. Both for lighting and cooking, gas appeared to be in favour, especially with the small householders, as instanced by the large number of prepayment meters supplied during the past twelve months. The Committee were, he said, again, on the advice of Counsel, applying to the Railway Commissioners for a review of the charges made by the Railway Companies for the conveyance of coal from Derbyshire and other districts to the Saltley Gas-Works.

After the resolution had been seconded, Mr. Lovsey made some allusion to the robberies from prepayment meters. He remarked that he had been informed that the officials compelled the consumers to lose the money, and also to make good the damage done to the meters. He suggested that the meters should be placed in less accessible positions. He also protested against the indicators at the top of the meters being of German manufacture.

Replying on these points, Alderman Sir Hallewell Rogers said the landlords decided where the meters should be fixed; the Committee's only stipulation being that they should be as near the front as possible. When the consumer was asked to pay for the damage to the meter, it was the damage to the cash-box part of it which was referred to; and this, of course, the Committee would expect the consumer to pay. With regard to the other matter, the order was given to a Birmingham firm; but the Committee could not be sure that every part of the meter was of English manufacture. He agreed with Mr. Lovsey that, where they could have English-made goods, they ought to have them.

The report was adopted.

GAS AND ELECTRICITY IN MARYLEBONE.

The Recent Failures of Electric Light—Removal of Gas-Lamps.

At the Meeting of the Marylebone Borough Council on Thursday, the Electric Supply Committee presented a long report on the recent failures of the electric light in Oxford Street, and stated that steps were being taken to prevent a recurrence of the interruptions. The report was adopted.

Mr. DUNN took exception to the following paragraph in the Lighting Committee's report: "We have given notice to the Gaslight and Coke Company to discontinue the supply of gas to the public lamps in Oxford Street, and have directed the Borough Surveyor to remove the whole of the gas-lamps and columns therein." He asked what was the reason for this haste. Common prudence would, he said, have dictated, in view of the two recent failures, to keep an alternative supply, in case of accident, at least for some little time. Ratepayers were now saying that the decision to remove the gas-lamps was a "burning of the boats," so that the electric light would have to be used, no matter how dear or how unreliable it turned out to be, because of the great expense involved in reinstalling gas. What guarantee was there that the electric light would not fail again next week?

Alderman MORRIS said it appeared to him that the action taken with regard to the removal of the gas-lamps was premature.

Alderman ANGLIM remarked that the gas-lights were so small that they would be of no use if the electric light failed.

A COUNCILLOR: They lighted the street for a good many years.

Mr. RICHARDS said the Council themselves did not trust the electric light, for there was a gas-chandelier in the Council Chamber where they were now sitting.

Mr. DEBENHAM, the Chairman of the Electric Supply Committee, said it was merely for ventilation.

Mr. RICHARDS went on to say that no one trusted the electric light; for in theatres, public buildings, and churches gas was also laid on. At dinner parties at his house, they had been plunged in darkness owing to the failure of the light.

Rev. J. A. BEAUMONT, alluding to the statement that the gas-chandelier in the Council Chamber was only there for ventilating purposes, said the gentleman who made it evidently was not aware that he (the speaker) and other members of a Committee would have been in the dark, on one occasion alone, for 25 minutes but for the chandelier. When those to whom gas was so obnoxious were considering how further to extend the electric light, he hoped they would bear this in mind.

Mr. E. T. FOWLER, the Chairman of the Lighting Committee, said the gas lamp-posts were being removed because they were an obstruction. The Consulting Electrical Engineer was confident that the electric light could now be relied upon.

After some further discussion, the report was adopted.

The Electric Supply Committee recommended that all consumers under the new rates whose accounts exceeded £50 per quarter should be allowed a discount of 25 per cent., provided the accounts were paid monthly within ten days of rendering.

Mr. DEBENHAM explained that the electric undertaking was feeling the severity of the gas competition.

Mr. HARPER objected to this further concession to large consumers. He said the policy seemed to be to squeeze the small consumer. He was paying more this year than last for the electric light.

Mr. KNIGHT said it appeared to him that they were fast approaching the stage when all ratepayers would have to pay the greater part of the cost of lighting the premises of big consumers in Oxford Street.

In the result, the recommendation was carried.

THE GAS INDUSTRY IN THE FIFTIES.

In the last issue to hand of "Progressive Age," there is an article by "S. A. G." containing some reminiscences of the gas industry in America half-a-century ago. He remarks that the manufacture of carburetted hydrogen gas was primitive then in comparison with the modern process now in use. The gas engineer of those days was a much more important personage than the present one. He was the sole authority for contracting and managing. Gas-works contractors did not furnish their own plans and specifications; they were merely bidders on the engineer's plans. The offices of the secretary and other officials were merely clerical positions; they had very little authority. Great secrecy and mystery pervaded the entire business, and there were no gas journals nor gas associations to publish information. The prices of gas ranged from $5 to $6 per 1000 cubic feet, and gas was used for illuminating only. Gas-ranges and gas-stoves were unknown.

Gas was made by carbonizing coal in iron retorts; 4 cubic feet per pound being the maximum obtained from Youghiogheny coal. After being driven off, the gas was washed in round iron box washers, condensed in pipe condensers, and purified with slaked lime; this process giving a heavy, rich gas of 18-candle power, and the only bye-products being coke and coal tar. The back-pressure maintained on the iron retorts was from 10 to 12 inches; and, as exhausters were not in use, the retorts soon became choked up with graphite, and had to be renewed, on an average, every twelve months. When clay retorts came into use, and high heats were employed in water-gas generators, the gas industry was materially changed.

Among the first gas-works built in the West were those at Cincinnati, Ohio, erected in 1841. The capital was furnished by Mr. J. H. Cauldwell, of New Orleans, who was owner of the St. Charles Theatre; the amount of capital being less than $100,000. He continued President of the Company until his death. The present capital of the Company is about $100,000,000, and a proportionate ratio of increase continues in the various companies throughout the country—showing a marvellous increase in volume of a product unknown a century before.

Meters used in the West were wet ones, filled with an anti-freezing fluid, requiring considerable attention, and having to be replenished with this fluid at short intervals to keep the water-line correct. The first consumers' dry meters used in the West were shipped from England from the factory of Mr. Thomas Glover in 1856, and consigned to the Cincinnati Gas-Works.

Many extra charges were also in vogue at that time; among them being the following: Meter-rent, 25 c. to 50 c. per month; service-pipes, 15 c. to 25 c. per lineal foot; stopcock for meter connection, $2·50; wood meter-box, $1·50; turning gas on again for delinquent customer, $1. Extensions and improvements were made from accumulated profits, and extra stock issued to cover the cost, increasing the market value of the stock to an extraordinarily high figure.

The foregoing reminiscences are a few notes from the memory of bygone days; the writer having been an employee of a gas company in 1851. Being still engaged in the gas industry, he is impressed by the progress that has been made in half-a-century; and he presented the few facts he has recorded for comparison with present conditions.

THE TRAINING OF GAS-FITTERS IN GERMANY.

A paper was read by Herr Heineken, of Bremen, before the last meeting of the Lower Saxon Association of Gas and Water Engineers, upon the classes for the training of gas-fitters which are now becoming common and highly popular in many parts of Germany.

The gas industry has made such rapid strides of late years that a dearth of men competent to superintend the manufacture of gas has made itself felt; but the same remark applies with even greater force to men thoroughly acquainted with the methods of fitting up indoor consuming plant and of laying down street-mains. The need for skilled men in both branches has been most acute in the eastern parts of Germany, where it has frequently happened that gas-works have been built to supply towns in which no capable fitter was to be found. The school in Bremen, already described in print, did not originally include in its curriculum any courses for fitters; but when the harm done to the gas industry in Eastern Germany through the absence of good workmen came to the notice of the Prussian Government about 1903, they sent officials to study the training methods adopted in the Bremen institution, which then felt it desirable to inaugurate special training for men in the distribution department.

With the aid of the information collected in Bremen, a gas-fitters' school has been founded in Posen as part of a general trade school already in existence there. The enterprise is greatly encouraged by the Government, which goes so far as to offer the students payment to the amount of 2s. or 2s. 6d. per day during the period of the classes, in recompense of the wages they lose, together with return railway fares to the place where the classes are held. Lectures are delivered in the mining school at Posen, and practical work is done in a shop belonging to the municipal gas undertaking—the head fitter of the works acting as superintendent under the direction of the teachers. Exactly similar courses are held at Bromberg under the same leadership, where the instruction lasts for three weeks, covering the subjects of gas, water, and low-tension electric mains. As many as 75 students have attended the courses at a time—necessitating the classes being held in duplicate. Training on the same lines is also given at Liegnitz for the province of Silesia, where the students have numbered 55; while the Trades Unions in Breslau, Liegnitz, and Oppeln, and the Silesian "Gewerbeverein," in conjunction with the Prussian Ministry of Trade and Commerce, have instituted four-week courses for gasmakers at Breslau on the Bremen pattern. The fees are 30s.; but poor men may enter free, and receive a sum of £3 to £6 for their expenses.

The school at Bremen has now been enlarged so as to give instruction to fitters also. The course is wider than elsewhere, covering every branch of constructional work in the domain of apparatus for the

consumption of gas. This has necessitated expensive equipment, the total value of which is about £250. The materials used in each course cost nearly £15. Many large makers of gas-fittings, however, have made handsome contributions of apparatus and material to the school. At the present time, 35 students can be provided simultaneously with material and tools. They work under the supervision of one teacher and two foremen or demonstrators; lectures being delivered in the Technical School at Bremen, and the practical work being done partly there and partly in a shop belonging to a firm in the town. During 1906, 71 students attended the classes for gasmakers, and 38 those for gas-fitters.

Quite recently a somewhat similar training establishment has been founded at Cologne. The course for gasmakers is four weeks shorter than at Bremen—lasting only for three months; whereas the course for fitters is considerably longer. The fees are only half as high at Cologne as at Bremen, and the new school is only arranged for the reception of 15 students.

BRADFORD WATER-WORKS LOANS.

Last Thursday, Mr. F. J. Willis, on behalf of the Local Government Board, held an inquiry at Bradford, with reference to the application of the Corporation for a Provisional Order to partially repeal, alter, or amend the Local Acts relating to the water undertaking, so as to fix a uniform period for the repayment of loans.

In his opening statement, the Town Clerk (Mr. F. Stevens) said that the application was to provide for an equation of the period for the redemption of the debt on the Corporation water-works. Money had been borrowed from time to time under various Local Acts; and it seemed desirable that steps should be taken for a simplification of the accounts, which were at present very complicated. For some years, the charges for interest and sinking fund had been increasing very rapidly—largely accounted for by the expenditure of money on the Nidd Valley works. The outlay involved, roughly speaking, an annual sinking fund of £18,000, and interest amounting to £31,000. The interest and sinking fund on all the works was £148,000; and to meet the burden it would be necessary for the Corporation to resort to a rate-in-aid, or to increase the price of water for trade purposes. It was proposed to get over the difficulty by spreading the charges over a longer period, which would involve no hardship on future ratepayers, as the works would last for at least a hundred years. It was proposed that the Local Acts should be altered so as to provide for the equation and consolidation of the loans over a period of sixty years. The debt to which the equation would apply was £2,998,781. It did not include the debt they took over from various Local Authorities. To meet this, they had a sinking fund of £109,889. Part of the debt was debenture stock and part short-term loans. About £831,201 was for short-term loans, and £2,159,580 was debenture stock, some portion of which was redeemable at fixed periods. This portion was £1,854,995; while the stock that bore no fixed date for redemption amounted to £304,885. It was proposed that a number of clauses in the Bradford Water-Works Acts of 1854, 1855, 1858, and 1862 should be wiped out; and that there should be inserted in the Provisional Order asked for a clause similar to that contained in the Bradford Corporation Gas and Improvement Act, 1871, empowering them to apply all moneys received in respect of water (1) in payment of the cost of raising and recovering the water-rates and borrowed moneys, (2) in payment of interest, (3) setting aside the sinking fund, (4) in management and maintenance charges, (5) in improvements and extensions, and (6) in any manner which the Corporation might deem best in the interests of the ratepayers. But whenever the income was insufficient for any of the purposes mentioned, the deficiency should be charged upon, and be payable out of, the city fund and rates. The effect of the last clause would be to empower the Corporation to apply any surplus from trading departments in relief of the water charges.

The Water Engineer (Mr. James Watson), in reply to a question by the Inspector as to the durability of the works, said that some of them ought to last hundreds of years. They had reservoirs which were sixty-five years old, that were better to-day than when they were built. The dams were of masonry, and the aqueducts of masonry and concrete. Some portion of the money would, of course, represent water-mains; but the bulk of the expenditure was in reservoirs and aqueducts.

The scheme was explained at length by the City Treasurer (Mr. G. A. Thorpe), who stated that during the proposed period of sixty years, the income would assuredly increase; so that after the lapse of seventy or eighty years there would be a profit of at least £12,000 a year, assuming the income was stationary. But as the population increased, so would the income from the water-works, and at the end of sixty years, there would be a large fund which could be used for the benefit of the inhabitants of Bradford. There was nothing in the whole scheme that would not commend itself to business men. It would equate the city burden; and the value of the works would be as great in sixty years' time as it was to-day.

THE NEW WATER SCHEME FOR LEEDS.

The proposed Bill of the Leeds Corporation—providing, among other things, for the abandonment of the old site of the Colsterdale reservoir, and the construction of another reservoir higher up the Burn Valley, Masham—which has twice been assented to by a majority of the members of the City Council, was exposed last week to the ordeal of the statutory meeting of ratepayers. The various sections of the Bill were taken separately; and that referring to the water scheme was passed almost unanimously by the sixty or seventy persons present.

In moving the resolution, Mr. Herbert Brown, the Chairman of the Parliamentary Committee, recalled the circumstances under which it was decided to alter the site of the Colsterdale reservoir—explaining that the estimated cost of the old reservoir was £932,007, with a daily supply of 9,469,813 gallons of water, while the estimated cost of the new reservoir was £436,800, with a daily yield of 8,149,029 gallons. The Corporation were, he said, endeavouring to provide an adequate supply of water for an increasing population. In 1906, the daily supply of water to Leeds had been 15,749,672 gallons, while the supply to outside places brought up the total to 16,232,954 gallons. The daily supply available from the present watershed was 16,500,000 gallons. In 1911, it was estimated that the city would require a daily supply of 18,025,596 gallons, which would be 1,525,000 gallons in excess of the present available quantity; and the estimated daily demand in 1916 was 19,474,660 gallons, or 2,974,668 gallons in excess

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 205

Issue.	Share.	When Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
590,000	10	Oct. 12	10½	Alliance & Dublin 10 p.c.	20½–21½	..	4 17 8
245,112	10	,,	7½	Do. 7 p.c.	14–15	..	5 0 0
200,000	5	Nov. 14	7	Bombay, Ltd.. . . .	6¾–7¼	..	4 16 7
40,000	5	,,	7	Do. New, £4 paid	5–5½	..	5 1 10
50,000	10	Aug. 30	14	Bourne- mouth Gas and Water } 10 p.c.	28–29	..	4 16 7
51,810	10	,,	7	B 7 p.c.	17–17½	..	4 0 0
53,200	10	,,	6	Pref. 6 p.c.	15–16	..	3 15 0
380,000	Stk.	Aug. 15	12½	Brentford Consolidated	262–267	+2	4 13 8
300,000	,,	,,	9½	Do. New . . .	200–205	..	4 12 8
50,000	,,	,,	5	Do. 5 p.c. Pref. .	120–125	..	4 0 0
206,250	,,	Dec. 13	4	Do. 4 p.c. Deb. .	101–104	..	3 16 11
220,000	Stk.	Sept. 27	11½	Brighton & Hove Orig.	232–237	+2	4 14 11
246,320	,,	,,	8½	Do. A. Ord. Stk. .	163–168	..	4 18 3
460,000	20	Sept. 27	10	British	41–43	..	4 13 0
104,000	Stk.	Aug 15	6	Bromley, Ord. 5 p.c.	121–125	..	4 16 0
165,700	,,	,,	4½	Do. do. 3½ p.c. .	91–94	..	4 15 9
500,000	10	Oct. 12	7	Buenos Ayres (New) Ltd.	11⅝–12	..	5 16 8
250,000	Stk.	Dec. 13	4	Do. 4 p.c. Deb. .	94–96	..	4 3 4
150,000	20	July 12	8½	Cagliari, Ltd.	24–26	..	6 6 11
100,000	10	Sept. 27	10	Cape Town & Dis., Ltd.	14–15	..	6 13 4
100,000	10	Oct. 26	4½	Do. 4½ p.c Pref.. .	9–9½	–¼	4 14 9
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	50–52	..	5 15 5
50,000	Stk.	Dec. 28	4½	Do. 4½ p.c. Deb. Stk.	96–98	..	4 11 10
157,150	Stk.	Aug. 15	5	Chester 5 p.c. Ord. . .	108⅜–110⅜	..	4 10 6
1,443,280	Stk.	Aug. 30	5⅛	Commercial 4 p.c Stk. .	110–113	..	4 12 0
560,000	,,	,,	5	Do. 3½ p.c. do. .	107–110	..	4 10 11
475,000	,,	Dec. 13	3	Do. 3 p.c. Deb. Stk.	83–85	..	3 10 7
800,000	Stk.	,,	6½	Continental Union, Ltd.	124–127	..	5 2 4
200,000	,,	,,	7	Do. 7 p c, Pref.	138–143	..	4 17 11
432,070	Stk.	Aug.	5⅛	Derby Con. Stk. . . .	122–124	..	4 8 9
55,000	,,	July	4	Do. Deb. Stk. . . .	105–107	..	3 14 9
486,090	10	July 27	11	European, Ltd. . . .	24½–25½	..	4 6 3
354,060	10	,,	11	Do. £7 10s. paid	18–19	..	4 6 10
15,203,110	Stk.	Aug. 15	4⅛	Gas- light and Coke } 4 p.c. Ord. . .	103–102	+1	4 6 3
2,600,000	,,	,,	3½	3½ p.c. max. . .	89–91	+1	3 16 11
3,799,735	,,	,,	4	4 p.c. Con. Pref.	107–110	..	3 12 9
4,193,975	,,	Dec. 13	3	3 p.c. Con. Deb.	84–86	..	3 9 9
258,740	Stk.	Sept. 13	5	Hastings & St. L. 3½ p.c.	98–103	..	4 17 1
82,500	,,	,,	6½	Do. do. 5 p.c.	118–121	..	5 7 5
70,000	10	Oct. 12	11	Hongkong & China, Ltd.	19½–20½	..	5 7 4
4,940,000	Stk.	Nov. 14	8	Imperial Continental .	178–180	+½	4 8 11
473,600	Stk.	Aug. 15	3½	Do. 3½ p.c. Deb. Red.	95–97	..	3 12 2
183,242	Stk.	Aug. 30	6	Lea Bridge Ord. 5 p.c. .	120–125	..	4 16 0
306,083	,,	Dec. 28	4	L'rpool Unit'd Deb. Stk.	110–112	..	3 11 5
561,000	Stk.	Aug. 30	10	Liverpool United A . .	227–229	..	4 7 4
718,100	,,	,,	7	Do. B. .	167½–163½	..	4 3 1
144,140	Stk.	Sept. 13	7⅞	Maidstone 5 p.c. . .	145–150	..	5 1 8
75,000	5	Nov. 29	5	Malta & Medn., Ltd. .	4¼–4⅜	..	5 5 3
560,000	100	Oct. 1	5	Met. of 5 p.c. Deb..	101–103	..	4 17 1
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	101–103	..	4 7 5
541,920	20	Nov. 14	3⅜	Monte Video, Ltd. . .	11½–12½	..	5 12 0
1,675,892	Stk.	Aug. 15	4⅝	Newc'tle & G'tesh'd Con.	110–111	..	4 3 4
406,025	Stk.	Dec. 28	3½	Do. 3½ p.c. Deb.	96–97	..	3 12 2
15,000	10	Aug. 30	10	North Middlesex 10 p.c.	20–21	..	4 15 3
55,940	10	,,	7	Do. 7 p.c.	13½–14½	..	4 16 7
300,000	Stk.	Nov. 29	8	Oriental, Ltd. . . .	150–155	..	5 3 3
60,000	5	Sept. 13	7	Ottoman, Ltd. . . .	6–6¼	..	5 7 8
398,490	5	Oct. 26	7	Primitiva Ord. . . .	7⅜–8¼	+⅛	4 6 2
796,980	5	July 27	5	Do. 5 p.c. Pref.	5¼–5⅝	..	4 10 11
488,900	100	Dec. 1	4	Do. 4 p.c. Deb. .	94–96	..	4 3 4
851,070	10	Oct. 12	7	River Plate Ord. . . .	12¼–12⅜	..	5 7 8
300,000	Stk.	Dec. 28	4	Do. 4 p.c. Deb. .	95–97	*..	4 2 6
250,000	10	Sept. 27	8	San Paulo, Ltd. . . .	13¼–13⅜	..	5 16 5
70,000	50	Jan. 2	5	Do. 5 p.c. Deb. .	48–50	..	5 0 0
135,000	Stk.	Sept. 13	10	Sheffield A	248–250	..	4 0 0
209,984	,,	,,	10	Do. B	248–250	..	4 0 0
523,500	,,	,,	10	Do. C	248–250	..	4 0 0
70,000	10	Oct. 26	10	South African	15½–16½	..	6 1 3
6,350,000	Stk.	Aug. 15	5⅜	South Met., 4 p.c. Ord.	128–130	..	4 4 7
1,895,445	,,	Jan. 16	3	Do. 3 p.c. Deb.	84–8.*	+½	3 9 9
201,720	Stk	Sept. 13	8	South Shields Con. Stk.	156–1.8	..	5 1 3
575,000	Stk.	Aug. 15	5⅜	S'th Suburb'n Ord. 5 p.c.	123–126	..	4 7 4
60,000	,,	,,	5	Do. 5 p.c. Pref. . .	123–126		3 19 4
112,533	,,	Jan. 16	5	Do. 5 p.c. Deb. Stk.	125 –130*	–½	3 16 11
502,310	Stk.	Nov. 14	5	Southampton Ord. . .	105–110	..	4 10 11
120,000	Stk.	Aug. 30	6⅛	Tottenham A 5 p.c. .	27–130	..	5 0 0
388,020	,,	,,	5	and B 3½ p.c. .	104–106	..	4 14 4
137,500	,,	Dec. 28	4	Edmonton 4 p.c. Deb.	101–103	..	3 17 8
182,380	10	,,	8	Tuscan, Ltd.	10⅜–11	..	7 5 6
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.	102 –104	..	4 16 2
193,742	Stk.	Sept. 13	5	Tynemouth 5 p.c. max.	106–108	..	4 12 7
30,000	Stk.	Aug. 15	8	Wands- worth A 5 p.c. . .	—	..	—
255,636	,,	,,	6⅛	B 3½ p.c. . .	140–145	..	4 9 8
75,000	,,	,,	5⅛	and C 3½ p.c. .	113–115	..	4 17 6
79,416	,,	Dec. 28	3	Putney 3 p.c. Deb. Stk	79–82	..	3 13 2
779,875	,,	Aug 15	5⅛	West Ham 5 p.c. Ord.	103–105	..	4 17 7
185,000	,,	,,	5	Do. 5 p.c. Pref. .	120–123	..	4 1 4
193,300	,,	Dec. 28	4	Do. 4 p.c. Deb. Stk.	102–105	+1	3 16 2

Prices marked * are "Ex div."

of the present available supply. Obviously something needed to be done; and the only alteration they proposed to make in the scheme of 1907 was to move the reservoir higher up the valley.

The proposal was seconded by Mr. Fred Ogden, the Chairman of the Water Committee, who pointed out that facts which came to light after the passing of the Bill in 1901 indicated to the Council that the scheme which had been decided upon was not the best that could be carried out. The present proposal aimed at remedying the defects discovered. In the matter of quantity of supply, the new scheme would be nearly as good as the original one; while in regard to cost, it would be much better.

There was some discussion, in the course of which Mr. J. Dransfield, the Elective Auditor, though not altogether against the scheme, prophesied that the cost would be a great deal more than the estimate.

NORTHAMPTON WATER SUPPLY.

Completion of the Ravensthorpe Well.

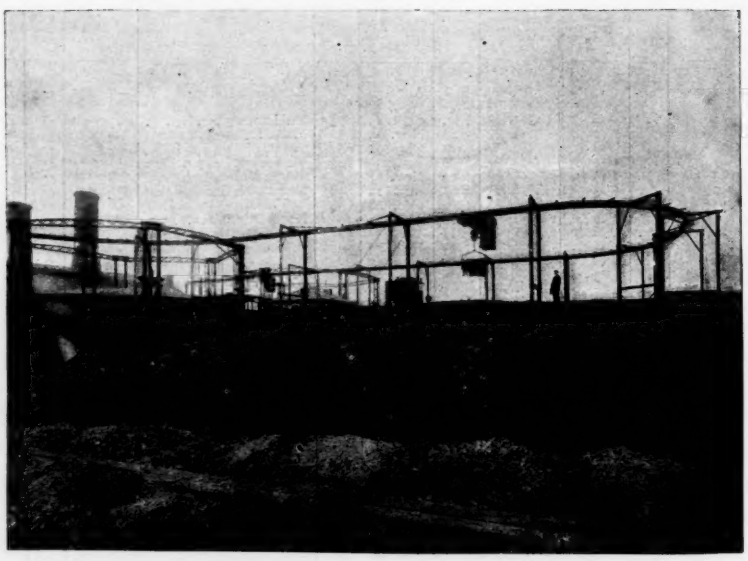
The members of the Water Committee of the Northampton Corporation, accompanied by three officials, drove over to Ravensthorpe a short time ago to examine the new well which has lately been completed. When it was decided to sink a well in close proximity to the reservoir at Ravensthorpe, it seemed absurd to some, who regarded it as probable that the water from the reservoir would percolate through to the well. But beneath the reservoir is a bed of impervious clay, so that fears on this account were not justified. This was proved by a trial shaft which was sunk to a depth of 90 feet, where the water had accumulated so rapidly that the suction-pipes had to be fixed beneath its surface. A tunnel was then commenced to tap fresh streams, and the work was continued for about 259 feet. Another shaft was therefore sunk (to a depth of 87 feet) some 300 feet from the end of the tunnel in a straight line; and from this end another drive was commenced which was ultimately to break into the former one. It was quite possible that when the two tunnels met there would be 30 or 40 feet of water, so the old heading was stopped with a 12-feet concrete wall, through which a pipe was driven, to safeguard the workmen. The new tunnel was started on the 26th of July; and the water-bearing strata were reached by the 26th of September, when 81 feet had been dug. The last 6 feet took three weeks to sink owing to the men having to work practically in a circular waterfall; indeed, something like 169,000 gallons of water were falling each day. The first difficulty of magnitude, however, was experienced when the tunnel merged into a fissure 6 ft. 6 in. wide. This was filled up with mud, &c., and a platform built. On this were placed bags of cement, which were forced up, making what was a weak spot one of great strength. The work was then carried on to completion. The full length of the tunnel is 562 ft. 3 in. It runs from north to south, and practically in a parallel line with the dam of the reservoir. Altogether, it is a very ingenious piece of work, and is highly creditable to its designer, Mr. Frank Tomlinson, the Water Engineer and Manager to the Corporation, who carried out the work.

The work has entailed an outlay of £4560, included in which sum is upwards of £600 for machinery. Valuing this at one-third its cost, the expenditure is £4360, of which £900 has been swallowed up in sinking the second shaft, which was not included in the original estimate submitted to the Local Government Board. This leaves at £3460 the cost of the work estimated for to the Local Government Board. The loan was for £3500. The only tender received amounted to £1200 more than the work has been done for; and this did not include sinking the second shaft. Had the whole been done by contract, the Engineer estimates that it would have cost £10,652. Having regard to the quantity of water pumped from the well, a comparison of cost is interesting. The cost of the reservoir was £126,000, and the Billing Road well cost the Water Company £24,000. The new well is not quite complete, though it can now be worked to supply the town. Beyond it, practically everything is of a temporary nature. It is anticipated that the proper machinery, which, it is said, will be more economical to use than the existing set, will cost about £6000; so that the total outlay on the work will be something like £10,000 or £12,000. Nothing, however, will be done in the way of getting new plant until the well has been adequately tested, so that the yield may be gauged. It will be used until the reservoir overflows; thus ensuring for Northampton a never-failing supply of water of great purity.

Reinstatement of Footways in Paddington.—The Paddington Borough Council have adopted the following charges per square yard in connection with the reinstatement of footways and carriage ways when disturbed by public companies and authorities other than the Post Office: 1-inch asphalte paving on 4-inch concrete, 14s.; 1½-inch do. on 6-inch concrete, 17s.; 1½-inch do. not on concrete, 12s. 6d.; 1½-inch lithofalt asphalte on 6-inch concrete, 17s.; 2-inch asphalte on 6-inch concrete, 19s.; 2-inch do. not on concrete, 14s. 6d.; concrete only, 1-inch thick, 1s.

Proposed Pension Scheme at Oldham.—At a recent meeting of the Oldham Gas Committee, the General Manager (Mr. Arthur Andrew) suggested that they should take into consideration the establishment of an old-age pension scheme for all the employees in the Gas Department. There were, he said, many men at present working there who had attained a good age; and rather than live on the charity of others, they were struggling on for subsistence. The Chairman (Alderman Hanson) said they could not consider the question then. Mr. Andrew remarked that they had as many old men in their department as in any other department of the Corporation. The matter would have to be started somewhere. The Chairman said that they might consider the question at the next meeting of the Lighting Sub-Committee; and Mr. Andrew was instructed to lay before the Lighting Committee some particulars regarding the proposal.

TEMPERLEY TRANSPORTERS



Temperley Transporter Plant for Storing Coke at the Paisley Corporation Gas-Works. The same plant is used for screening and loading into delivery carts.

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NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Scottish Junior Gas Association—Eastern District—had before them, at their quarterly meeting in Edinburgh this afternoon, two communications of an instructive nature; the first being a description, by Mr. Henry Rule, Assistant Gas Manager at Falkirk, of the stoking machinery in use in the Corporation Gas-Works there, and the second a lecture on "Suction Gas Producers," by Mr. John T. Wight, Assistant in the Heriot-Watt College, Edinburgh, to Professor Stanfield. The second communication, being a lecture, was not open to discussion. The first was; but the remark is common to both, that neither was suitable for discussion. They were descriptions of apparatus, dealing with matters of fact, which cannot be controverted. If Mr. Rule had had time to go more fully into his subject, which we all know he unfortunately had not, having the full responsibility thrown upon him of the management of the Falkirk Gas-Works during the present vacancy, he might have given more working results than he did, and then members could well have compared them with those obtained by other methods of stoking. All that could be done was simply to ask a few explanatory questions; and these were frankly answered by Mr. Rule. The excellence of the paper cannot, therefore, be judged by the amount of discussion which took place upon it. Its value lay in the information given of the construction and methods of working of the plant. A fuller description could not have been desired; and in this connection commendation must be made of the series of beautiful diagrams by which the paper was illustrated. Mr. Wight's lecture was a comprehensive one, dealing with almost every type of suction-gas plant in the market, pointing out where they varied, and the advantages claimed for each. The lecture was an admirable one; but its good effect was greatly marred by the failure of the lantern to show the slides. It was lighted by electricity, and the only comment upon its working which would be at all near the truth would be that when it was not in a condition to make a clear figure upon the screen it was out altogether, the periods of total darkness most tantalizingly occurring, for the most part, at the points where it fell to the lecturer to deal with some more than ordinarily important items of arrangement. This was the only blemish upon the meeting. In spite of it, there was a great deal learnt about the working of suction gas-engines. A word as to the figures given by the lecturer as results. These may be accepted as accurate, so far as they go; but they are sadly incomplete as a means of judging as to the respective duties of engines driven by producer and by town gas. There are many elements to be taken into consideration besides those enumerated, such as the first cost and upkeep. Before a manufacturer could, with anything like reliability, decide as between the two powers, he would require a much more exhaustive comparison.

In the Hamilton Town Council on Tuesday, it was reported that a claim for damages had been made upon the Corporation, in respect of injuries sustained by a gas consumer through an explosion of gas in his house. The Manager reported that the meter had been wilfully tampered with; and it was agreed to repudiate liability for the claim, and to raise a counter-action for the damage done to the meter. Bailie Meechan called attention to the bad quality of the gas which was at present being supplied to consumers; and Bailie Hamilton, the Convener of the Gas Committee, in reply, while admitting that there had been a few complaints, said that one complaint was made at that table, and that when the Gas Manager went to investigate it he was refused admittance. Generally speaking, the complaints were found to be due to lack of proper attention to the fittings and burners. Bailie Meechan said he considered that gas ought to be manufactured that could be used with flat-flame burners. Bailie Hamilton, on the other hand, considered that they must go along with the times, and not lag behind. A report by the Manager—Mr. J. Ballantyne—was submitted, in which he stated: "With regard to the smells from the gas-works, these are not caused by the working of the sulphate of ammonia plant, and the plant was not working on the date specified. The complaints, to a great extent, evidently arise from quenching coke with the waste liquor, and so long as this practice is continued, there will always be a certain smell peculiar to the operation. So far as the present arrangements allow, this has been reduced to a minimum by pumping a certain amount of the liquor into the quarry, and diluting the remainder with clean water before it is used for quenching the coke. . . . With reference to bad gas, it will be remembered that when the coal supply was purchased last May, it was pointed out that the quality would be reduced from half-a-candle to a candle; and this is what has actually taken place. The question of quality simply means whether we are to cater for the old-fashioned, and now to a great extent antiquated, form of flat-flame burners, which have done duty for the last eighty years, or supply a gas suitable for the modern incandescent burner. Most of the complaints, however, seem to be from those using incandescent burners, in which case it is either owing to the want of a proper supply of gas, or the burners not being properly regulated, or using mantles unsuited for the particular kind of burner. Of late I have been using more cannel, and less soft coal, to obviate these complaints; but it is quite well known that it is only a question of time, and that not very long at the best, till there will be little or no cannel coal to be obtained, and then consumers will be compelled to use a gas of inferior quality. An effort was made, some four years ago, to get the local tradesmen to take up the matter of keeping incandescent burners in repair, and cleaning them periodically, as these burners require a little more care and attention than flat-flame ones to obtain the most satisfactory results; but all the negotiations fell through, as the tradesmen did not seem prepared to take the matter up." The minutes of the Gas Committee were adopted; and it was agreed to circulate literature giving instructions as to the use of incandescent burners among the consumers.

In the Lanark Town Council on Monday, the Town Clerk reported that notice had been given of the Council's having adopted the Burghs Gas Supply (Scotland) Acts, and that there had not been any remonstrance from any ratepayer. The confirmation of the adoption of the Acts will

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COLSTON HALL. BRISTOL.

now be proceeded with. The Council sat in private to consider the report by Mr. W. R. Herring, of Edinburgh, upon the condition of the gas-works and plant; but it is understood that no formal decision was come to.

A question having been raised in the Dunfermline Town Council on Monday as to the quality of gas for power purposes, Bailie Stewart, the Convener of the Gas Committee, said that the following questions had been sent to the makers of gas-engines whose engines were in the town: (1) Whether gas made from common coal, and enriched with benzol to 21-candle power, is as good for gas-engines as common coal gas, enriched with cannel to 21 candles? (2) Which gas will develop the greater power, apart from price? (3) How the change of gas and the change of price from 3s. 2d. per 1000 cubic feet to 2s. per 1000 cubic feet should have raised or lowered gas accounts for gas-engines? One firm replied: (1) "Gas made by you, and enriched with benzol, is equally as good for gas-engine purposes as gas previously enriched with cannel; (2) the maximum power of a gas-engine will be about 4 per cent. less with the benzol-enriched gas than with the cannel-enriched gas, apart from the price per 1000 cubic feet, or the quantity of gas used; (3) there should be 40 per cent. decrease in the gas account for gas-engines by the change in explosive value and change in price of gas which your Commissioners have made." Mr. Waddell, the Convener said, did not claim a 40 per cent. decrease; but he said that the gas for power purposes was equal to anything required. The replies received from the makers of gas-engines should be even more favourable now, because since the letters were received the price of gas for power purposes had been reduced to 1s. 9d. per 1000 cubic feet.

On Thursday, the 9th inst., a meeting of the Directors of the Girvan Gaslight Company was held in the office of Mr. Tait, the Secretary to the Company, and, after the conclusion of the ordinary business, the Directors agreed to visit and inspect the improvements at the gas-works, which, during the past eight months, have undergone a wonderful change. The retort-house walls have been raised all round, a new roof has been put on, and a new bench, containing three ovens and retorts, built by Mr. Workman, of Saltcoats, including ironwork; a horizontal steam-boiler, by Penman and Co., of Glasgow, has been put in; a new scrubber and exhauster house has been erected; a new Bryan Donkin exhauster to pass 10,000 cubic feet per hour has been put down; also one of Clapham's patent scrubbers, with 8-inch connections; a Tangye tar-pump, with 3-inch connections; a new tar-tank to contain 7000 gallons; a new lime-shed, new office, new store, and new weigh-bridge, &c. The Directors, who were accompanied by their respected Gas Manager, Mr. Thomas Watson, having examined the works, expressed appreciation of their tidy appearance and general management, which they said reflected great credit on the Engineers, Messrs. Fairweather, of Kilmarnock. The total cost of the work was only about £1300.

On Tuesday, the Gas Committee of the Falkirk Corporation, out of the forty applicants for the post of Gas Manager, selected the following as a short leet: Messrs. J. Lang, of Fraserburgh, Thos. Lighbody, of Renfrew, A. M. Smith, of Darwen, J. M'Leod, of Glasgow, W. Wilson, of Kirkintilloch, A. Mackay, of Montrose, and G. Keillor, of Broughty Ferry.

An action has been called in the Court of Session, before Lord Salvesen, at the instance of the Edinburgh and Leith Gas Commissioners, against the Kinneil Cannel and Coking Coal Company, Limited, of Glasgow. The nature of the action has not been disclosed; but it may be said that the Company do not supply largely to the Commissioners.

A pleasant little ceremony took place in the house of Mr. Andrew Mackenzie, of Messrs. Alder and Mackay, in Edinburgh, on Thursday evening, when presentations were made to Mr. and Mrs. Mackenzie on the occasion of their silver wedding. Mr. Mackenzie is known to all gas managers in Scotland, and to many out of this little kingdom, as a most faithful and energetic representative of his firm, and also as an entertaining companion and attached friend; and it was in both capacities that his friends in the gas profession honoured him and his lady. I believe that such a presentation is unique in the history of the gas industry in Scotland. Mr. Mackenzie's popularity in the circle of his acquaintance is shown by the number of gas managers who contributed to the presentation.

At the Buckhaven Town Council, on Monday, Mr. Cormie said he thought the time had now come when the Council ought to consider the advisability of the burgh doing its own lighting. They were at present served by two Gas Companies—the Leven and the East Wemyss (one on each side of the burgh)—and the rates charged were very high as compared with Alloa, where the price was 2s. 1d. per 1000 cubic feet. He thought they should have municipal control of the gas undertaking. It was agreed to ask the East Wemyss Gas Company to erect two lamps, to enable the Council to judge as between their efficiency and that of the two electric lamps which have been offered by the Wemyss and District Tramway Company.

Gas Stoker's Death at Newcastle.—At an inquest on the body of William Watt, a gas stoker, evidence was given to the effect that while he was employed at the Newcastle and Gateshead Gas Company's works, some few weeks ago, he slipped and fell. He had since been medically attended; and the doctor attributed death to paralysis, due to hemorrhage on the brain, caused by a fall. The jury returned a verdict of "Accidental death."

Rural Water Supplies in Lincolnshire.—An inquiry has lately been held, on behalf of the Local Government Board, at Billinghay, into an application made by the Sleaford Rural District Council for sanction to borrow £10,750 for the purposes of a scheme of water supply for several of the parishes in the district. Dr. Giles, the Medical Officer for the district, said that South Kyme, one of the parishes in the scheme, obtained its main supply of drinking water from the River Slea, which received the undiluted sewage of Ruskington and various other sewage pollutions. During the last twenty years, there had been many cases of typhoid fever due to drinking water from the river. Half the houses in Martin, another of the parishes, were without any water supply. The samples of drinking water he had analyzed were badly polluted.

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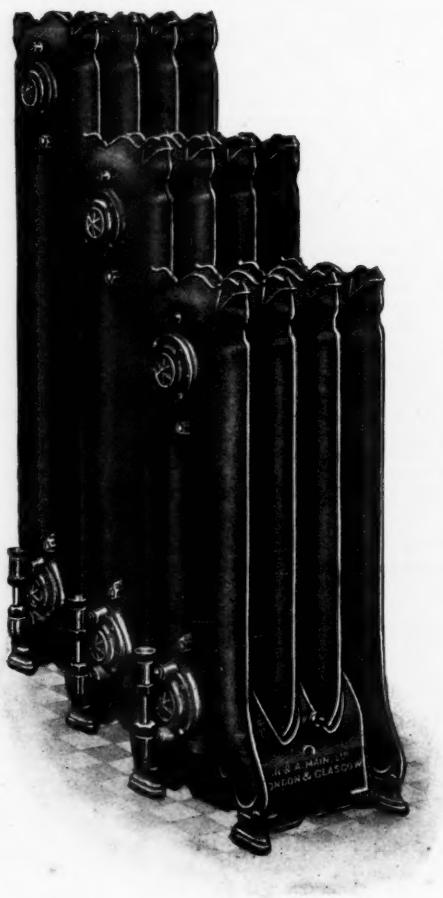

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CURRENT SALES OF GAS PRODUCTS.

Week ending Jan. 19.

There has been a good deal of activity in London tar products during the last week or two. The lower price for pitch has brought in many buyers, and important sales are reported for the second half of this year at much better prices than some recently-recorded sales for prompt delivery. This is of importance, and should prevent distillers from making heavy sacrifices unnecessarily. The present value is 27s. to 27s. 6d. net, with a very good demand for both prompt and forward. Ninety per cent. benzol is from 1s. to 1s. 1d. net. Solvent naphtha is much stronger, at 1s. 9d. to 1s. 10½d. net, casks free. Ordinary creosote is 2¼d. to 2½d. net. Sulphate of ammonia is much firmer, with a stronger demand. Beckton terms may be called £12 5s. to £12 7s. 6d. over the next three months.

LIVERPOOL, *Jan.* 19.

Sulphate of Ammonia.

The week opened with a quiet market, but towards the close there has been improvement at all points. Buyers who have hitherto been hanging back have recognized that the level of prices is favourable for buying, and have been covering their requirements more freely; so that at the close the quotations are £11 15s. per ton f.o.b. Hull, £11 17s. 6d. per ton f.o.b. Liverpool, and £12 per ton f.o.b. Leith. There has also been more inquiry for spring delivery, but, as buyers' views are not much above spot prices, while makers are looking for a premium of 7s. 6d. to 10s. per ton, business has been very limited in this position.

Nitrate of Soda.

This article is quiet, but spot prices remain 11s. 3d. per cwt. for 95 per cent., and 11s. 9d. for refined.

LONDON, *Jan.* 19.

Tar Products.

There has not been very much business doing in tar products during the past week. Pitch is quiet; business having been done at 24s. on the east coast. It is reported in Liverpool that 23s. 9d. was accepted for prompt delivery, and an offer to place some quantity at 24s. Manchester was unsuccessful. The London value remains about 25s., though something under this would have to be accepted if prompt shipment was required. There has been a little business doing in both South Wales and on the Continent for delivery to June, but at very low prices. Creosote is very firm, though in London there is some quantity selling for prompt delivery at low figures. In the North, however, manufacturers refuse to quote; while in the Midlands they ask 2¼d., and even at this figure will only submit small quantities. Solvent naphtha is not quite so firm; and it is reported that some quantity was offered on the east coast at 1s. 1½d. for delivery from now to the end of June. Benzol, 90 per cent., also is easier—1s. having been accepted in London for a small quantity; while much lower prices are prevailing in the North. 50-90 per cent. is steady; business having been done in the Manchester district at equal to 11⅜d. per gallon. Carbolic acid is certainly quieter. Manufacturers have accepted 1s. 8d. for delivery on their works to the end of June; while it is impossible to obtain more than 1s. 8½d. on the east coast. Crystals are unchanged in value, though a certain amount of business is reported to have been done at market prices. The market for toluol is steady; but nothing of importance has transpired, and values are unaltered. There is no business to report in anthracene.

The average values during the week were: Tar, 13s. to 17s. Pitch, London, 24s. 9d. to 25s.; east coast, 24s. to 24s. 3d.; west coast, 23s. 6d. to 24s. 6d. Benzol, 90 per cent., 11½d. to 1s.; 50-90 per cent., 11½d. to 11⅜d. Toluol, 1s. 1½d. to 1s. 2d. Crude naphtha, 4¾d. to 5d.; solvent naphtha, 1s. 1½d. to 1s. 3½d.; heavy naphtha, 1s. 3d. to 1s. 5d. Creosote, London, 2d. to 2¼d.; North, 2d. to 2⅛d. Heavy oils, 2⅛d. to 2⅝d. Carbolic acid, 60 per cent., 1s. 8½d. to 1s. 8¾d. Naphthalene, £5 to £9; salts, 34s. to 35s. Anthracene, "A" quality, 1⅛d. to 1⅝d.

Sulphate of Ammonia.

The market has been decidedly firmer during the past week. In London, the principal Gas Companies maintain their quotations of £12 2s. 6d. for prompt, and £12 5s. for forward; but business is reported to have been done in outside makes at a distinct advance upon last week's figures. In Hull, business has been done at £12 for prompt and forward, though in the case of the prompt, it was a very fine make that was offered. In Liverpool, business is reported to have been done at £11 17s. 6d. for prompt; while a small quantity was also sold at this figure for February-March, which was certainly cheap, as nothing under £12 would receive any consideration to-day. In Leith, buyers have offered £11 17s. 6d., but without success; and makers, being well sold, do not appear at all disposed to quote.

Poole Water Arbitration.—The arbitration to determine the price to be paid by the Poole Corporation for the undertaking of the local Water Company will be held in London early in March; and the proceedings are expected to extend over two or three days. The Arbitrators are Mr. Henry Rofe, M.Inst.C.E., on behalf of the Corporation, and Mr. G. R. Strachan, M.Inst.C.E., for the Company; while Mr. Ram, K.C., will act as Umpire.

Quality of the Oystermouth Water Supply.—In a report which has been discussed by the General Purposes Committee of the Oystermouth Urban District Council, the County Medical Officer of Health expresses his surprise that the Council have not taken up the question of water supply in earnest, and he states his belief that there are no signs that they intend to do so, "until an epidemic visits the district, and plays havoc with the inhabitants." Mr. Rees asked why the County Council, who were above the District Council, did not take the initiative; but the Clerk replied that it was not their duty to do so. He added that the Council could buy out the Water-Works Company; but this would very largely increase the rates. It was decided to send to the Company a copy of the County Medical Officer's report.

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ACTUAL FACTS

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The success of the Bland Burner has exceeded my expectations.

The Saving on this quarter alone has been 33.400 ft. to the value of £6. 13. 7.

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Naked Burners 65. 200

Xmas Qr. 1906
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33. 400.

During the whole of this past quarter - we have not received a single complaint or gloom.

Yours faithfully
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COAL TRADE REPORTS.

Lancashire Coal Trade.

There is a good demand for all kinds of coal in the Lancashire district. The miners are working full time. The recent increase in prices offers no bar to purchasers. Contractors are eager to enter into negotiations for six and twelve months' supplies. Contracts for fuel are made at all times during the year, and there are terminals occurring monthly. Buyers opening new contracts for burgy and slack from the end of January will have to pay an increase of from 10d. to 1s. per ton. There has been quite a sensational rush for shipping coal of late, both for bunkers and for export. It is stated that one colliery proprietor near Manchester, a few days ago, had to decline, from general pressure, a proffered order for 2000 tons of coal for export. Coalowners are sanguine that if the present satisfactory outlook continues, prices will show a further advance in the near future. Cannel, as well as gas coal, is on the rising scale. The average quotations are: Best house coal 14s. to 15s. per ton, secondary 13s. to 14s., common 10s. to 12s., burgy 8s. to 9s., best slack 7s. 3d. to 7s. 9d., medium 7s., common 6s. to 9s. 6d., coal for bunkers and export 10s. to 11s., and furnace coke 17s. to 24s.

Northern Coal Trade.

The coal trade is very firm; and though the output is full, it is well taken up. For early delivery, however, there is some difficulty in arranging purchases. Prices have thus advanced rather sharply; and the tendency appears to be still upwards. In steam coals, best Northumbrians are now quoted as high as 13s. 3d. to 13s. 6d. per ton f.o.b., second-class steams are about 12s., and steam smalls are from 7s. 6d. to 8s. 6d., while forward sales seem numerous, with higher prices in some cases. In the gas coal trade, there is a keen demand, though the deliveries on the long contracts now begin to show signs of lessening. Durham gas coals vary more in price, as sales are now being made for delivery over the shipping season. Current quotations for gas coals vary according to the quality, and are from about 11s. 3d. to 12s. 6d. per ton f.o.b. The contracts for Copenhagen are now definitely settled; and the quotations are about 15s. 9d. to 17s. per ton, free at Copenhagen—the latter price being estimated to leave 12s. 4½d. to 12s. 6d. per ton f.o.b., according to the allowance that is made for the freight. It is a sharp rise on the price that was paid last year, when allowance for the past tax is made. Coke is very firm; but gas coke seems to be offered more plentifully. The quotation varies from 12s. 6d. to 13s. 6d. per ton f.o.b. on Tyneside.

Scotch Coal Trade.

Trade remains steady—outputs going off freely, and prices being well maintained. The export trade has not yet recovered the buoyancy it had before the New Year; but the outlook is hopeful. The prices quoted are: Ell 10s. 9d. to 12s., splint 12s. to 12s. 6d., and steam 10s. 3d. to 10s. 6d. The shipments for the week amounted to 180,861 tons—an increase of 83,074 tons upon the preceding week, but a decrease of 11,596 tons upon the same week of last year. For the year to date, the total shipments have been 278,648 tons—a decrease of 16,470 tons upon the corresponding period of 1906.

Bath Gas Company and Local Ironmongers.—At a recent meeting of the Bath Ironmongers' Association, a satisfactory report was given by Mr. W. C. Lee of his interview with the Engineer and Manager of the Bath Gas Company (Mr. C. Stafford Ellery), who had agreed that the retail price of certain gas-stoves should be the list quotation, less 5 per cent. for cash and 10 per cent. to gas-fitters.

Damages for a Gas Explosion.—At the Omagh Quarter Sessions, a man named Colton, and his wife, obtained £25 damages from the Omagh Urban District Council for injuries done to their house and furniture by a gas explosion last November. The accident was caused by an escape of gas from a pipe under the house. The total damage was estimated at £36 18s.; and the Council (who own the gas-works) offered £20 and costs.

Cutting-off Water for Non-Payment of Rates.—The St. Pancras Borough Council have received a letter from the Metropolitan Water Board with reference to the disconnection of supplies for non-payment of the water-rate, stating that it is not considered advisable to entirely abandon the practice; that the power to cut off supplies has been very sparingly used; that no supplies are disconnected without the order of the Board's Committee being first obtained; and that it has been the practice to refrain from giving such orders where the premises are known to be occupied by more than one family, and in genuine cases of poverty. During the half year ending Michaelmas last, out of a total of nearly 1,100,000 supplies, only 213 were actually withdrawn. Of these, 132 were merely turned off at the stopcock; leaving only 81 cases where a physical disconnection was made. In this period, the number of supplies disconnected in St. Pancras was five.

Gas Lighting Matters in Lambeth.—The Lighting Committee of the Lambeth Borough Council report that the cost of the conversion of the public lamps in the Gaslight and Coke Company's district to the incandescent system has been paid off. The work was carried out in 1903-4 at a cost of £2044 4s. 11d., which was lent by the Company for three years without interest. The Council will now reap the full benefit of the reduced cost of lighting as compared with the flat-flame system. The Baths and Cemetery Committee report that they have been compelled to partially revert to gas lighting in the public wash-houses, as it was found impossible to keep the electric incandescent lights in good order owing to the steam. It has been decided, when the baths completion works are considered, to provide arc lamps in place of the electric incandescent lights. As, however, it will only be possible to keep these lamps alight when the Council's engines are running, and as it is necessary at times to have another means of lighting in case the electric light fails, the Chief Engineer has been directed to utilize the old electric light standards for gas supply; and the work is now being carried out. Incandescent gas-burners have been placed in the West Norwood Library, in substitution for the gas-lights which were previously there.

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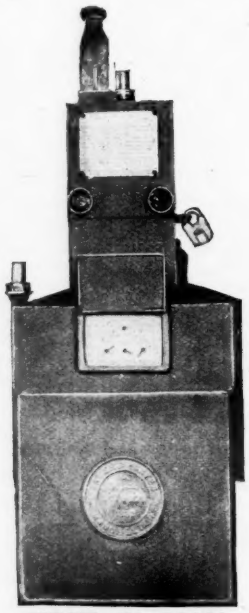

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Coal and its Bye-Products.

There was a large and appreciative audience at the Stockton Literary Institute last Wednesday night, to hear a lecture by Mr. Matt Dunn, the Assistant-Manager of the Corporation Gas-Works, upon "Coal: Its History and Bye-Products." The lecture was the continuation of a previous one delivered before the members on "Coal: Its Formation and Uses." After giving a brief synopsis of his previous lecture, Mr. Dunn dealt at considerable length with the history of coal; tracing our knowledge of it to the present time, and dealing not only with England, but with Greece, China, Italy, Egypt, Asia Minor, and other countries. Following up the historical aspect of the subject, he dealt with the extent of the existing coalfields in this country, and referred to those at present untouched, but available for future use. Estimating the total quantity, he pointed out the seriousness of the export trade. The quantity exported had increased from about 9 per cent. in 1857 to over 25 per cent. now. The available coal supply of the country would probably last for 400 years, but in another 50 years the coal available would be so deep, and the cost of winning it so great, that it would be possible and probable for foreign coal to be imported and sold at a less price. Giving the proportions of coal used in various ways, he stated that 8 to 10 per cent. was utilized for gas making, 30 to 40 per cent. for iron smelting, and upwards of 25 per cent. was exported—the remainder being consumed in factories, houses, locomotion, and other ways. The residual products of coal were dealt with most exhaustively; the lecturer's remarks being graphically illustrated by various plants, including a miniature tar-distillation plant. There was also exhibited a large collection of tar products. The lecture was illustrated by numerous lantern slides; and at the close a hearty vote of thanks was accorded to Mr. Dunn.

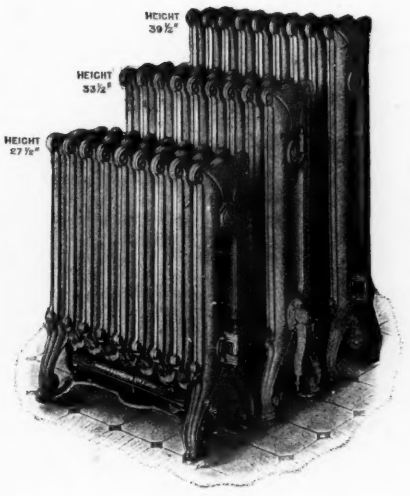
Automatic Light Controlling Company, Limited.

At the first ordinary general meeting, last Thursday week, of the British, Foreign, and Colonial Automatic Light Controlling Company, the Chairman (Sir Edward P. Wills, Bart.) said the Directors felt they had every cause to congratulate the shareholders. It would be within the knowledge of most that the Company was formed to acquire the business of the Automatic Light Controlling Company, which had been established at Bournemouth for five years, and which transferred its valuable patent rights, agreements, benefit of contracts, &c. Notwithstanding the many difficulties inseparably associated with the removal of the Company to Bristol, the revenue from sales and hiring agreements had during the past twelve months realized a highly satisfactory sum. The turnover had yielded a profit sufficient—after charging the Managing-Director's and Secretary's salaries, Directors' fees, depreciation upon controllers on hire, and one-third of the formation expenses—to provide for a dividend upon the preference shares, and leave a disposable balance of £771. The Directors were determined to build up an adequate reserve fund; and they were therefore prepared to add to the above-mentioned balance the amount of their fees already charged—£400. Of the £1182 thus available, they proposed that so much of it should be transferred to the general reserve fund as would bring the fund up to £1300, and that the balance then remaining be carried forward to the current year's account. The system of automatic lighting and extinguishing of lamps—both electric and gas—was imperfectly understood by the public. Was it for one moment realized that the adoption of this Company's system would, in a city the size of Bristol, mean a saving to the ratepayers of many thousands a year—a saving effected not only in the expense of labour, but also in the decreased consumption of gas? At a moderate estimate, the rates might thus be reduced by nearly 1d. in the pound. Many cities had already availed themselves of the system; and he felt that it was only for its capabilities to become well known, for all great towns to adopt what was clearly proved to be a large saving to the community. Already negotiations were opened for the working of the patents in France and Germany. The Managing-Director (Mr. John Gunning) said the system was already in use in Brighton, Chesterfield, Carlisle, Dover, Darlington, Eastbourne, Folkestone, Maidstone, Neath, Newcastle-on-Tyne, Oxford, Poole, Queenstown, Salisbury, West Hartlepool, Yeovil, and many other places of importance in the British Isles; besides, Melbourne, Napier, Maidstone, Dunedin, Ballarat, Christchurch (New Zealand), and St. John's (Newfoundland), in the Colonies. The report was adopted.

Hull Corporation Bill.—The Town Clerk of Hull has received a requisition for a poll of the citizens on the Corporation Bill; and it will be taken towards the end of the month. The poll has been demanded on all the proposals, and not only on that dealing with the purchase of the undertaking of the East Hull Gas Company.

Municipal Electricity Supply at Woolwich.—Following on the report of Sir Alexander Kennedy on the Woolwich electricity undertaking, to which reference has already been made in the "JOURNAL," comes the report of the Auditor, which is said to be one to alarm the ratepayers. The Chairman of the Finance Committee (Dr. T. A. Ingram) recently stated that, so far from having a working balance of from £2000 to £10,000 (as provided in the bye-laws), the Council were faced with an overdraft of £60,000. Of this sum, £42,000 represented capital expenditure on electricity supply. The accounts of the department were in such a state that neither the late nor the present Council could apply for a loan, because they did not know on what the money had been spent, and could not allocate it to its proper account. The only way he could see of clearing off the overdraft was by an increase in the rates of (say) 6d. or 8d. in the pound. Remarking on the position, a correspondent of "The Times" says: "There can be no doubt that the financial situation in Woolwich is exceedingly serious, and that the continued loss on the Electricity Department is mainly responsible for the present position of affairs. Every unit sold means further loss; and, as an indication of the policy adopted by the Labour majority in the last Council, it may be pointed out that the price for current to the private consumer is less than that charged for current for street lighting"

RICHMOND'S RADIATORS



1. "A Marvel."

"Merchant of Venice." Act 2—Scene 6.

2. "The Gem of All."

"Hamlet." Act 4—Scene 7.

3. "Goodly Things without Contradiction."

"Taming of the Shrew." Act 1—Scene 1.

4. "Very Excellent Piece of Work."

"Taming of the Shrew." Act 1—Scene 1.

5. "Workmanship and Value."

"Cymbeline." Act 2—Scene 4.

ADVERTISEMENT OF THE RICHMOND GAS STOVE & METER CO., LTD.
London Offices and Show-Rooms: 132, QUEEN VICTORIA STREET, E.C.
General Offices and Works: WARRINGTON, &c.

Cheap Gas for Power at Mansfield.—The Mansfield Gas Committee propose that the following scale of charges shall be adopted with reference to the use of gas for engines only: Under 50,000 cubic feet per quarter, 2s. 2d. per 1000 feet; over 50,000 and under 100,000 feet, 2s.; over 100,000 and under 150 000 feet, 1s. 9d.; 150,000 cubic feet per quarter and over, 1s. 6d. These rates are intended to come into operation from March 31.

Private Bill Business for Next Session.—Last Wednesday was the final day for depositing memorials complaining of non-compliance with Standing Orders in the case of the petitions presented for Bills for next session. Only one relates to a measure in which our readers are interested, and it is the memorial of the Llantrisant and Llantwit Fardre District Council and others in respect of the petition for the Ogmore and Garw Urban District Council (Water Supply, &c.) Bill.

London County Council's Book-Keeping.—Mr. Holt Schooling, the well-known statistician, has made a remarkable criticism of the London County Council's methods of account-keeping in a report he has compiled on the Council's finances. "During my 26 years of actual experience in scrutinizing the accounts of many different organizations," he writes, "I have never met with any set of accounts that so notably lack lucidity and inter-related accuracy as these accounts of the London County Council."

Additional Capital for the Chigwell, Loughton, and Woodford Gas Company.—Last Tuesday, Mr. Alfred Richards sold, in accordance with instructions received from the Directors, a new issue of £3000 of consolidated ordinary stock of the above-named Company. It ranks for a standard dividend of 5 per cent. per annum, subject to the sliding-scale; and the interim dividend on the Company's existing similar capital for the half year ending the 30th of June last was at the rate of 5½ per cent. per annum. The prices realized ranged from £105 to £110 10s. per £100 of stock.

Guiseley Water Purchase Question.—The Guiseley Urban District Council, at a special meeting in committee, have decided to offer the Guiseley Water Company £12,000 for the whole of their undertaking, subject to the conditions that the Company give a guarantee in writing to accept the offer, to transfer to the Council the agreement at present existing between them and the Yeadon Water Company, and also to pay the costs of conveyance to the Council. The offer is, of course, also subject to the approval of the Local Government Board and of the ratepayers of Guiseley. The Company's Directors, subject to the approval of the shareholders, asked £12,000 for the works; so that the only difference between the parties is the cost of the conveyance.

Saltash Water Supply.—The difficulty caused by the leaking of the main laid on the bed of the River Tamar, to which reference was made in the "JOURNAL" last week, has caused the Saltash Town Council to consider other schemes for conveying water to the town from Plymouth. Last week the Council met in committee, and considered a scheme by Mr. H. Bulteel, of Plymouth, to lay a 5-inch steel main across the Royal Albert Bridge. It is proposed to put the main between the railway line and the side of the bridge, and to cover it, reduce the pressure of the water to 90 lbs. per square inch, and provide sluices at both ends of the bridge, so that the water can be cut off in case of accident. The Great Western Railway Company are to be asked for the terms on which they will allow the main to be laid. An amendment to the effect that a consulting engineer should be called in to consider the whole question of the water supply of the town, was defeated; and the Council were also opposed, on the ground of cost, to a suggestion that steps should be taken to obtain a water supply from the Cornish side of the river.

Curious Gas Suffocation Case.—A strange gas fatality has occurred at Merryhull Hall, the property of the Birmingham and several other Boards of Guardians. The Works Foreman, named Willetts, slept in the place last Thursday week; but on the following morning he did not get up as usual. The caretaker went to his room; and receiving no answer to his knock, he called to another man, and the two entered the room. A strong smell of gas was then noticed; and Willetts was seen lying dead on the floor near a gas-fire. A gas-jet was burning, but the stove jets were not; and investigation proved them to be turned off. A gas-fitter named Sparkes subsequently examined the whole of the fittings of the room, and found them in proper order. At the inquest, Dr. Parsey testified that death was due to suffocation through inhaling gas. Sparkes advanced the theory that when putting out the stove deceased accidentally turned on one of the taps. He would probably go to sleep, but would be awakened by the effect of the inhalation of the gas, and would get out of bed to try the gas-taps. The escaped gas would be very dense near the floor; and inhaling this, he would be overcome. The Coroner supported this conjecture; and the Jury returned a verdict of "Accidental death."

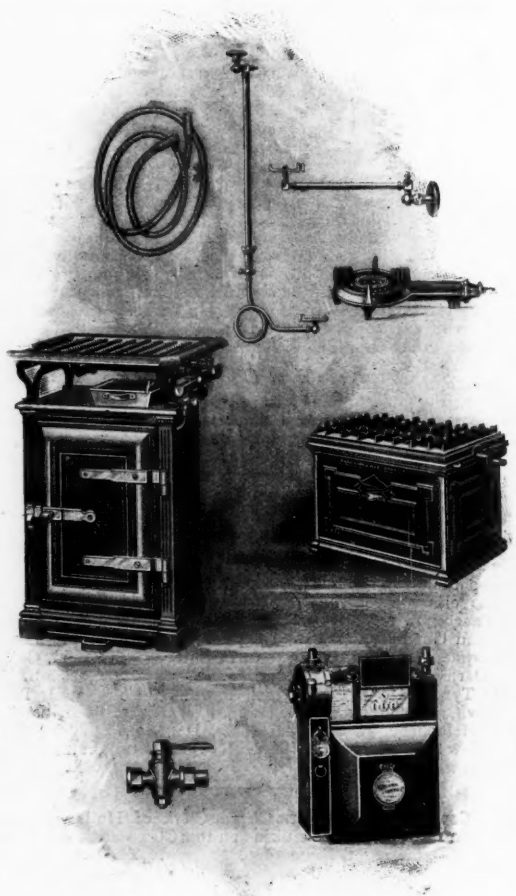
The Electric Light Standards in Oxford Street.—The Hon. Secretary of the Roads Improvement Association (Mr. Rees Jeffreys) recently addressed a letter to the Local Government Board, drawing attention to the row of electric standards being erected in Oxford Street between the Marble Arch and Oxford Circus. He pointed out that standards in the middle of the street had been found in practice to be a source of danger to the public, and had been condemned by the Royal Commission on London Traffic. Other districts in London which had in years past erected such standards were now removing them. For example, the borough of St. Pancras had recently been at considerable expense in taking down the central electric standards which obstructed the road between the Portland Road Station and Tottenham Court Road. On behalf of his Association, therefore, he asked the Board to make representations to the Marylebone Borough Council on the subject. Mr. Jeffreys has received a reply from Mr. H. C. Monro, one of the Assistant-Secretaries of the Board, to the effect that the matter is not one in which they have any authority enabling them to intervene. In sending the correspondence to the papers, Mr. Jeffreys writes: "The matter furnishes another illustration of the great and urgent need for the establishment of a permanent Traffic Commission for the Metropolitan area, on the lines recommended by the Royal Commission. There are over 90 independent and uncontrolled highway authorities in the Metropolitan Police district."

PARKINSON'S

COMPLETE

SLOT

INSTALLATIONS.



PARKINSON AND W. & B. COWAN, LTD.

(Parkinson Branch),

Cottage Lane, City Road, LONDON. | Bell Barn Road, BIRMINGHAM.

Sulphuric Acid Manufacture at Bradford.—The Bradford Gas Committee are about to recommend the Council to spend £3250 in extending the sulphuric acid plant at the Frizinghall Chemical Works. It is stated that at present the Committee are only utilizing about half of their total quantity of spent oxide in the manufacture of sulphuric acid; but the enlargement of the plant will permit of all being made use of, and will practically double the output of acid.

Gas Suffocation Case at Banbury.—A young girl who entered domestic service at Banbury on Monday of last week, was found dead in bed the following morning with the room full of gas. At the inquest, the mistress explained that the gas-bracket had two arms, from one of which a small piece of tubing was suspended. There were thus two taps, one of which was found turned half on. The Coroner suggested that the piece of tubing should be removed from the bracket, as it was possible that the hand of deceased, after she turned out the gas, caught against the tubing and touched the other tap, turning it partly on. The Jury found that the cause of death was suffocation by an accidental escape of coal gas.

The European Gas Company have announced an interim dividend of 5 per cent.

The Directors of the Brentford Gas Company recommend dividends at the rates of 5, 12½, and 9½ per cent. per annum for the past half year, carrying forward £53,306.

A movement is on foot among the owners of gas coal pits in Nottinghamshire and Derbyshire to form themselves into an Association, with a view to reducing competition and maintaining prices at regular levels.

Messrs. A. E. Podmore and Co. have just issued a catalogue (arranged in a convenient form for the pocket) of their dust and insect proof burners, self-intensified lamps, pendants, and other specialities for outside and interior lighting. It is artistically got up, and will be useful to managers when calling upon consumers with reference to alterations in, or new installations of, lighting appliances.

The Vale of Leven Gaslight Company, with its office in North Street, Alexandria (N.B.), was registered in Edinburgh last week. The capital is £27,250, in shares of £5 each, for which the public are not asked to subscribe; and the object is to manufacture and sell gas for any purpose within the county of Dumbarton or elsewhere.

The Richmond Gas Stove and Meter Company's gas-steam radiators have just been installed in the Tivoli Theatre, Dublin, and in Covent Garden Theatre, London. Other places of importance recently fitted with their radiators are: St. James's Court, Buckingham Gate, S.W.; St. George's Church, Kensington; St. James's Church, Paddington; Christ Church, Harlesden; and Victoria Hall, Kensington.

A public meeting has been held at Brough, near Kirkby Stephen, to consider the new scheme of water supply from Ravenstonedale, and the suggested apportionment of the cost (estimated at £8500) over the several interested parishes. There was strong opposition to the proposal, on the ground of the great expenditure involved; and on a show of hands being taken, the meeting voted unanimously against the scheme.

A scheme has been prepared for supplying water to Accra from the Adjementa Valley, in the neighbourhood of Aburi, on the Gold Coast. It was anticipated that the carrying out of the scheme would have been commenced during the past year; but the prolonged drought of the last three years has caused doubts to be felt as to the sufficiency of the original scheme, and a special expert is to inquire into and report on the whole subject, after personally examining the various sources of supply.

In an address on the Leicester Gas Department, Councillor Edwards stated that they used 1000 tons of coal a day, employed 1300 men, owned 90 miles of mains, and had 50,000 customers. When the undertaking belonged to the Company, the price of gas was 2s. 10d. per 1000 cubic feet; to-day it was 2s. 4d., while no charge was made for meter-rent. In another 32 years, the profit on the undertaking would be £100,000 per annum, which, with the profits from the other municipal concerns, would mean that Leicester would be a free rated town.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

MANAGER (SMALL WORKS). No. 4702.
DRAUGHTSMAN. No. 4703.
GAS ACCOUNTANT AND COLLECTOR. Nantwich Gas Department. Applications by Jan. 31.
WORKS FOREMAN. No. 4701.
REPRESENTATIVE (Coal). No. 4694.

Situations Wanted.

POSITION IN OFFICE OF CONSULTING ENGINEER (View to Partnership). No. 4695.
REPRESENTATIVE (STOVE). No. 4704.

Plant, &c., for Sale.

COMPLETE GAS-WORKS PLANT AND APPLIANCES (NEW STREET GAS-WORKS, EDINBURGH). Edinburgh and Leith Gas Commissioners.
STOCKPORT GAS-ENGINE. "G. H.," West End Advertising Agency.

Plant, &c., Wanted.

GAS-METER (20,000 feet). Leatherhead Gas Company.

Stocks and Shares.

PORTSMOUTH WATER COMPANY. Feb. 6.

Company Meetings.

BARNSTAPLE GAS COMPANY. Bridge Hall, Barnstaple. Feb. 16. Twelve o'clock.
GASLIGHT AND COKE COMPANY. Chief Office. Feb. 1. Twelve o'clock.
SOUTH METROPOLITAN GAS COMPANY. Cannon Street Hotel. Feb. 13. Two o'clock.

TENDERS FOR

Fire-Clay Goods.
BIRKENHEAD GAS DEPARTMENT. Tenders by Jan. 24.

Water-Gas Plant.
NELSON GAS DEPARTMENT. Tenders by Feb. 4.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

TERMS OF SUBSCRIPTION to the "JOURNAL."

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Abroad (in the Postal Union): £1 7s. 6d., payable in advance.

Subscribers who desire to avail themselves of the reduction in the Subscription by paying in advance for the Year 1907, are reminded that this can only be done during the current month.

All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

OXIDE OF IRON.

O'NEILL'S OXIDE
For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE,

SPENT OXIDE PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO., LD.,
PALMERSTON HOUSE,
OLD BROAD STREET, LONDON, E.C.

WINKELMANN'S
"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

SULPHURIC ACID for Sale, specially suitable for making Sulphate of Ammonia.
BROTHERTON AND CO., LTD., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, WAKEFIELD, and SUNDERLAND.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM and 54 & 47, Westminster Bridge Road, LONDON, S.E.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS, AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
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ANTIMONY OXIDE MANUFACTURERS—
FOR COATING GASHOLDERS, &c.;
ALSO BUYERS OF RETORT CARBON, ANY QUANTITY.

WALSAM DAVEY AND CO.,
REGENT HOUSE, REGENT STREET,
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MEADE-KING, ROBINSON, & CO. Represent the Strongest Independent Refineries in America; also Petroleum Spirit for Gas Enrichment. 18, EXCHANGE STREET, MANCHESTER, and 11, OLD HALL STREET, LIVERPOOL.

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SPECIALLY prepared for the Manufacture of SULPHATE OF AMMONIA.
SPENCER, CHAPMAN, & MESSEL, LTD.
with which is amalgamated WM. PEARCE & SONS, LTD.),
36, Mark Lane, LONDON, E.C. Works: SILVERTOWN.
Telegrams: "HYDROCHLORIC, LONDON."
Telephone: 341, AVENUE.

TAR AND LIQUOR WANTED.
Best Prices paid.
DENT AND CO.,
Ouse Chemical Works, SELBY.

ROBERT DEMPSTER & SONS, Ltd.,
Contractors for Complete CARBONIZING PLANTS and every description of GAS APPARATUS and ELEVATING and CONVEYING PLANT, Rose Mount Iron-Works, Elland.

GAS TAR wanted.
Brotherton and Co., Ltd., Tar Distillers. Works: Birmingham, Glasgow, Leeds, Liverpool, Wakefield, and Sunderland.

INCREASE YOUR MAKE.
SEND for Particulars of the "RAPID" Carburettor. Why be short of Gas when you can stretch the make from 1000 to 2000 cubic feet per ton, without any difficulty?
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JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 50 Years. References given to Gas Companies.

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MANCHESTER, S.W.
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For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

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Correspondence invited.

SULPHATE OF AMMONIA SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants.
We guarantee promptness, with efficiency for Repairs.
Joseph Taylor and Co., Central Plumbing Works, Bolton.
Telegrams: Saturators, Bolton. Telephone 0848.

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ALEXANDER WRIGHT & CO., LTD.,
1, Westminster Palace Gardens, Artillery Row, Victoria Street, Westminster, S.W.

HYDRATED OXIDE OF IRON.
PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Exchanged for Spent Oxide.
Read Holliday and Sons, Ltd., Huddersfield.

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CARBURINE FOR GAS ENRICHING.
ALSO
THE MAXIM PATENT CARBURETTOR.
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7, Bishopsgate Street Without,
LONDON, E.C.
Telegraphic Address: "Carburine, London."

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MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. Blakeley, Gas Engineer, Thornhill, Dewsbury.

GAZINE—A radical Solvent and Preventative of Naphthalene deposits, and the Automatic cleaning of Mains and Services.
It is also used for the Enrichment of Gas, and has an illuminating value double that of 90 per cent. Benzol.
Supplied by C. Bourne, West Moor Chemical Works, Killingworth, or through his Agent, F. J. Nicol, Pilgrim Street Chambers, Newcastle-on-Tyne.
Telegrams: "Doric," Newcastle-on-Tyne. National Telephone No. 2497.

BRISTOL RECORDING GAUGES AND THERMOMETERS.
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AMMONIACAL Liquor wanted.
Brotherton and Co., Ltd., Ammonia Distillers. Works: Birmingham, Glasgow, Leeds, Liverpool, Wakefield, and Sunderland.

STOVE SEASON, 1907.
GENTLEMAN with First-Class connection desires a change.
Address No. 4704, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

POSITION, with view to Partnership, desired in the Office of a Consulting Gas and Water Engineer.
Address No. 4695, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, a Coal Representative for Yorkshire and Lancashire who has been successful in his sales to Gas Companies in these districts.
Apply, by letter, to No. 4694, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

MANAGER wanted for Small Gas-Works in County Durham. Twenty-eight retorts. Public Lighting.
Apply, by letter, with References to No. 4702, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, a good leading Draughtsman, accustomed to Constructional Ironwork and Gas Plant, for Works in the North of England.
Full Particulars of Experience, stating Salary required, to be forwarded to No. 4703, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WORKS FOREMAN.
WANTED, for abroad, for large Gas-Works, a First-Class WORKS FOREMAN. Must be a good Carbonizer, thoroughly understand the working of Inclined Retorts and Carburetted Water-Gas Plant, capable of Organizing and Controlling Labour, and be systematic in routine. Must have held a similar position.
Apply, by letter, stating Age and Experience, together with *copies* of Testimonials, to No. 4701, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

NANTWICH URBAN DISTRICT COUNCIL.
APPOINTMENT OF GAS ACCOUNTANT AND COLLECTOR.

THE Council invite Applications for the above Position.
Salary £135 per Annum, rising £10 each Two Years to a maximum of £165.
Applicants must be between the ages of 25 and 40.
Applications, endorsed "Gas Accountant," stating Age, previous Occupation and Experience, and when at liberty, with *copies* of Three recent Testimonials, to be sent to the undersigned (from whom Particulars of the duties may be obtained) not later than the 31st day of January, 1907.
Canvassing will disqualify.
By order,
A. E. Whittingham,
Clerk to the Council.
7, Mill Street, Nantwich.
Jan. 13, 1907.

WANTED, a Second-hand Gas-Meter for about 20,000 cubic feet per hour. Must be in good condition.
Send Particulars and Price to the Secretary, Leatherhead Gas Company.

PURIFIERS wanted, 10 feet, 12 feet, and 15 feet square Boxes. Gasholders up to 100,000 cubic feet capacity. Every description of Plant bought and dismantled. Scrap Buyers of old Meters, Brass, Copper, and other metals for Cash.
State Particulars and Quantities to Firth Blakeley and Co., Gas Plant Buyers, Dewsbury.

FOR SALE, CHEAP—A Quantity of good Donkin's 12-inch GAS-VALVES; also a very good 3 B.H.P. GAS-ENGINE (Stockport).
Apply, S. While and Son, 60, Queen Victoria Street, London, E.C.

FOR SALE—50-H.P. Stockport Gas-ENGINE, Single Cylinder type, fitted with two 7-feet Fly Wheels and outside bearings on each end of crank shaft. Complete with Gas Bag, Silencer, Meter, Exhaust Piping, &c.
Apply to "G. S.," care of West End Advertising Agency, 195, Oxford Street, W.

BOROUGH OF NELSON.
CARBURETTED WATER-GAS PLANT.

THE Gas Committee invite Tenders for the supply and erection of a CARBURETTED WATER-GAS PLANT at their Brierfield Works.
Specification and full Particulars may be obtained on application to Mr. A. J. Hope, Engineer and Manager, Gas Offices, Nelson.
Tenders, endorsed "Gas Plant," to be sent to the undersigned not later than Monday, Feb. 4, 1907.
The Committee do not bind themselves to accept the lowest or any Tender.
J. H. Baldwick,
Town Clerk.
Town Hall, Nelson,
Jan. 18, 1907.

TO RETORT AND FIRE-BRICK MANUFACTURERS.

THE Corporation of Birkenhead are prepared to receive TENDERS for RETORTS, BLOCKS, FIRE-BRICKS, FIRE-CLAY, &c., required at the Gas-Works during the current Twelve Months.
Forms of Tender may be obtained from Mr. T. O. Paterson, Gas Engineer, Gas-Works, Thomas Street.
Tenders, sealed and endorsed "Tender for Retorts, &c.," to be sent in to me not later than Five o'clock in the afternoon of Thursday, the 24th of January, 1907.
The person whose Tender may be accepted will be required to enter into a contract containing a clause as to the payment of the rate of wages, and the observance of the hours of labour recognized and agreed upon between the Trades Unions and the Employers in the locality in which the work for carrying out the Contract is to be performed.
The Corporation do not bind themselves to accept the lowest or any Tender.
By order,
Alfred Gill,
Town Clerk.
Town Hall, Birkenhead,
Jan. 17, 1907.

THE GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that a HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors of this Company will be held at this Office on Friday, the 1st day of February next, at Twelve o'clock (noon) precisely, to transact the usual Business, including the declaration of a Dividend for the Half Year ending on the 31st day of December last, and to elect Directors and Auditors in the place of those who will at such Meeting go out of office in compliance with the Company's Acts or Schemes of Amalgamation.
By order,
Henry Rayner,
Secretary.
Chief Office, Horseferry Road,
Westminster, S.W., Jan. 14, 1907.

SOUTH METROPOLITAN GAS COMPANY.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Proprietors of this Company will be held at the Cannon Street Hotel, in the City of London, on Wednesday, the 13th day of February next, at Two o'clock in the afternoon precisely, to receive the Directors' Report and the Accounts of the Company for the Half Year ended the 31st of December last; to declare a Dividend for the same period; and to elect Two Directors and One Auditor in the place of those retiring by rotation.
The TRANSFER BOOKS WILL BE CLOSED from the 30th day of January inst. until after the Meeting.
By order,
Frank Bush,
Secretary.
Offices: 709, Old Kent Road,
London, S.E., Jan. 19, 1907.

BARNSTAPLE GAS COMPANY.

NOTICE is Hereby Given, that the ORDINARY GENERAL MEETING of the Shareholders of the above Company will be held at the Bridge Hall, Barnstaple, on Saturday, the 16th day of February, 1907, at Twelve o'clock noon, to receive the Report of the Directors and the Accounts for the Year ended the 31st day of December last, to declare Dividends, to elect a Director and an Auditor, and to transact the General Business of the Company.
The TRANSFER BOOKS WILL BE CLOSED from the 3rd to the 16th of February (both days inclusive).
By order of the Board,
F. L. Schofield,
Secretary.
Offices: 15, Cross Street, Barnstaple,
Jan. 17, 1907.

ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.
Terms for Issuing such Capital, and also for including in these Periodical Sales Gas and Water Stocks and Shares belonging to Private Owners, can be obtained on application to Mr. Alfred Richards' Offices, 18, Finsbury Circus, E.C.

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